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[OFFICIAL NOTICE.]

OFFICE AMERICAN GAS-LIGHT ASSOCIATION,
117 BROADWAY, N. Y. CITY, Sept. 15, 1879.

*To the Members of the Association :*

The Seventh Annual Meeting of the Association will be held at Philadelphia, Pa., on the 15th, 16th, and 17th of October. Headquarters at the Girard House, Ninth and Chestnut streets. Meetings to be held in Franklin Institute Hall.

All members who intend to present papers to the meeting are requested to inform the Secretary by letter at once.

Each member expecting to attend the meeting will confer a favor upon the local committee of arrangements, by notifying the undersigned of such intention at the earliest possible day.

CHARLES NETTLETON, *Secretary.*

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

## THE SEVENTH ANNUAL MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

Before our next issue the Seventh Annual Meeting of the American Gas Light Association will have commenced its session in Philadelphia.

From indications that are unmistakable the meeting will be one of unusual interest.

The attendance will be full, as nearly one hundred members have already signified their positive intention of being present; and, at the same time, the number of papers to be read will undoubtedly be equal in importance and interest to those of any previous meeting. Our views upon the value of these meetings have been so often expressed that it would seem almost useless to present them again; but at a time like the present it does seem of more than usual importance that every man, who can by any possibility be present, should be there, and add whatever he may be able to contribute to the success of the Association. For a number of years past the country has been struggling under the inevitable results of extravagance flowing from an inflated, fictitious, speculative prosperity.

The lesson that has been brought home in many cases has been one taught by a hard, relentless master; and, although hard to bear, there is no doubt but that the result has been for the general good. Fortunes have vanished. Property supposed to be valuable has been proved to have no solid basis. Business has been at a stand still, and economy has been forced upon every one in every direction. No better indicator of all this can be found any where than in the monthly statements of gas sold, which every manager has been obliged to watch much more closely than ever before.

Accompanying the reduced consumption, resulting from the general prostration of business, has been the loud demand for a reduced price of gas, enforced in many instances by a resort to the kerosene lamp. The manager finds himself often in a position where, on the one hand, he is urgently requested to secure the usual dividend, and, on the other he is persistently urged to furnish his gas cheaper by the consumer.

Often the former demands come from those who cannot be made to see that lower price means increased sales, and an equivalent total profit; and, sometimes, he knows full well that the demand of the consumer cannot be met without some sacrifice in the amount of dividend. Economy (so-called) in repairs and construction is enforced with a hope of bridging over the hard times. Needed extensions, in order to meet a revival of prosperity, have been postponed; but only for a time as the limit must be reached where this can no longer be done.

The time must come when the very best possible apparatus, the most economical working, and the most strictly correct and scientific management must be relied on to keep the balance sheet good and the price down. It seems, from all the information available, that returning prosperity is at hand. Business is better, and many a manager will be able to report an increased send-out over last year. Now is the time when every manager must be prepared beforehand with well matured plans for meeting the increased business which all so eagerly desire. There is nothing that enables every man to come to a clear, satisfactory conclusion, as to what is the best, so well as meeting together and exchanging ideas and experience.

Advances are being made daily in gas manufacture which no manager can afford to neglect, and those will be the most successful who most closely keep pace with the real improvements of the age. The time is coming when education of a higher order will be required of the gas manager, not an ed-

ucation from books alone, but one derived from experience in the practical application of the correct principles that may be learned either from books, or personal instruction of those who have acquired a knowledge of the scientific principles laid down in books.

Nothing does a man more good than to get outside of his usual horizon and see for himself what others are doing. He may be doing either better or worse himself, in either case benefit will follow.

There is no reason why, with about 900 gas companies in this country, the membership of the National Association should be so small as it is—the entire membership being about 200.

Every manager should be a member, and contribute to its usefulness as well as share in its benefits. In this way it would become a power for good that cannot be easily estimated. Let those who have not already joined do so, by sending in their names at once for election at the coming meeting, which, we have the most positive assurances, will be one long to be remembered.

The gas interest in this country is large enough, and the capital involved is sufficient to make itself felt if only concentrated in one harmonious policy. The people require cheaper gas, and the gas manager is the man who must be able to meet the demand.

Gas in New York.—No change has taken place in the prices of gas since our last issue. Rumors of adjustment are floating about; but, as yet, we are unable to learn of any definite action. Prices of gas stock, however, have advanced somewhat, which would indicate that the public do not believe that the gas business has gone to the dogs altogether.

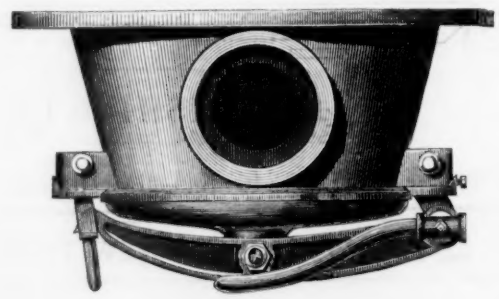
## Gas and Gunnery.

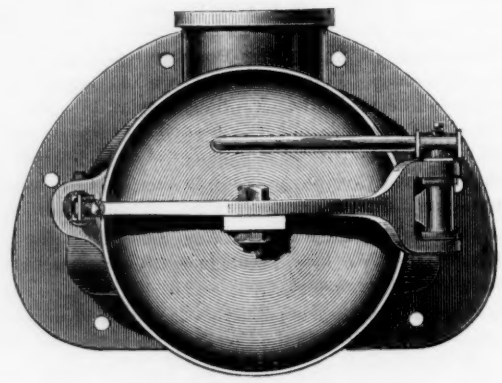
It would appear that considerable anxiety is again being manifested by the Gaslight and Coke Company in regard to the safety of its gasholders at Beckton, in view of the experiments that have been somewhat frequent at Woolwich of late for the purpose of testing heavy ordnance. There would also seem, we confess, to be good grounds for this anxiety. As our readers are aware, there are, at the Beckton Gas Works, a number of gasholders of large capacity, completed and in use, and we hear that more are in course of construction. Notwithstanding the large area of the Beckton Works, the holders are somewhat close together and consequently receive a concentrated shock from the violent concussion which ensues from the firing of our large guns. We understand that the directors of the company have made very earnest representations to the Government on the subject, and as the result of a series of observations that have been made recently by the engineer of the company, and also by military officers, it has been found, at least so we are credibly informed, that each shot produces a bulging-in of the holder plates to the extent of half an inch. The plates of the holders in question, we are told, are an eighth of an inch in thickness, and it cannot but occur to one that continuous shocks cannot be received by such structures without the risk of serious damage. It is urged by the company that bolts may be started, and the side of the holder which receives the shock is likely to fall to pieces, involving very possibly most disastrous consequences. There can be no doubt that this is a most serious matter, not only to the company, on account of the gigantic character of the financial interests at stake, but also to the public. When it is borne in mind that the Chartered Gas Company is responsible for the lighting of about three-fourths of the whole metropoltan area, it will be at once apparent that any general failure of the gasholders at these particular works would bring about a state of affairs one can scarcely venture to contemplate; and therefore, in the interests of the public, the question is one demanding the most serious attention. It is argued, we believe, by some Government officials, that as the Beckton Works were established subsequently to the time at which the Plumstead Marshes were appropriated to artillery experiments, the company came to the nuisance, and not the nuisance to the works. This is very true; but, as a contemporary points out, the guns proved up to the time of the Beckton Works were established were of a very different calibre to those which now shake the earth and smash the windows for miles around. It can scarcely be said that the Beckton Works came to eighty-ton or one hundred-ton guns. The remedy suggested is, of course, that the War Office authorities should remove their experimental ground to a locality more remote from large industrial establishments liable to such risks as the Beckton Works are now exposed to; and, for our own part, we are bound to say that we think the time has come when the testing of those monsters should no longer be carried on in the midst of a thickly-populated and rapidly-growing district.—London *Metropolitan*.

Professor Henry Morton, Ph.D., President Stevens Institute of Technology, begins a series of articles on "Water Gas; Its History and Manufacture," in the October first issue of *The Plumber and Sanitary Engineer*.

## The Morton Patent Self-Sealing Mouth Piece and Lid for Gas Retorts.

The Morton Patent Self-Sealing Mouth Piece and Lid for Gas Retorts, illustrated by the following cuts, in top and front view, were first introduced in England about 10 years ago, where there are over 20,000 now in use; and since 1873 they have been used with great satisfaction in many works in this country.





The mouth piece is made preferably with a circular front, so as to facilitate facing to a true plane, the turned-up edge of lid being finished to a semi-circular, or ⊰ section, so as to approximate to a line bearing, is pressed tightly against the face of the mouth piece, by the action of the cross bar and eccentric hinge-pin, which gives at the same time a light longitudinal motion to the lid, insuring the perfect sealing of the joint.

The contact surfaces are readily kept clean by using a scraping-tool, and the other parts, being of the simplest possible construction, are easily comprehended by the stokers, who gladly welcome this improvement, which relieves them of considerable labor, and, at the same time, effects a great economy in the production.

Mr. Henry G. Morris, 209 South Third street, Philadelphia, who is sole manufacturer of these mouth pieces and lids in the United States, informs us that he will have one on exhibition at the coming convention of the American Gas Light Association.

Optical Arrangements for Street Illumination.—Various attempts have been made to improve street illumination by the use of optical arrangements. The prevailing idea seems to be that by some combination of optical apparatus the amount of light from a given source of gas illumination may be enormously increased. We need hardly say that nothing of the kind can possibly happen; the gas gives its light, and distribute it how you will that light cannot be increased in quantity. The last experiment in this direction was made at Bristol, where, last week, the Borough Surveyor placed between two bat's-wing burners a convex lens. The effect of this may be readily guessed—a great display of light up and down the street; no increase in the roadway or under the lamp irons—in fact, a total failure so far as to effect any improvement in street lighting. We are sorry for this because we do not feel certain that optical arrangements may not in the end produce a very useful effect; at present we do not see any apparent. The trial of the bull's eyes, in Sackville Street, proved a ridiculous failure; but the experiment in Bristol is much more promising. The lens will require to be most carefully adjusted, and, what is more, the lens will require to be ground and focussed with much accuracy. It is not sufficient that an ordinary convex lens should be stuck up an left to produce its effect; an especial lens, or, rather, many lenses, must be constructed. Then comes the difficulty of focalizing on windy nights. Altogether we are inclined to think that street illumination had better be left to the gas companies.—London *Journal of Gas Lighting*.

[From the London "Journal of Gas Lighting."]

## Annual Meeting of the North British Association of Gas Managers.

Mr. David Terrace (Abroath) read a paper on

WORKING STATISTICS.

In offering a few remarks on this subject, I would draw attention more particularly to the discrepancies in the working results obtained in various gas works.

Seeing that such a society as this has existed for so long a period, one would suppose that the actual work done throughout the year, in one works compared with another, would be nearly alike; but, instead of this we find the greatest difference arising. For instance, beginning with the retort house, the quantity of gas made per mouthpiece per day is found to be 5,000 feet in some works, while in others 8,000 feet are obtained. The production per ton of coal carbonized is said to be under 10,000 feet in one place, compared with over 11,000 in another. Thus the amount paid for carbonizing wages, etc., is greatly increased for the lesser quantities, not to mention the destruction of the extra material and plant required.

These results might be due to the method of setting the retorts; also in some measure to the kinds of coal used, and the length of time the charges are worked. It does not seem to be a settled point whether 3, 3½, or 4 hour charges are best, and each manager has his own proportion of first, second, and third class coals. It ought now to be well known whether settings of three or five retorts in one oven are most economical to work. Settings of five to one furnace are being adopted, but the ordinary rule is three retorts to one furnace. There are, however, instances where two furnaces are employed to heat three retorts.

So far as I am aware, there are no data as to the quantity of coke used as fuel in proportion to the quantity sold. As a basis, it might be mentioned that if two-thirds of the coal carbonized produces good coke, this will be sufficient to keep the furnaces and also the steam boiler supplied with fuel.

The gas produced per ton of coal used should be within from 5 to 10 per cent. of the analysis quantity, and this percentage should be worked out daily, or as often as there is a change made in the quantities or kinds of coal used.

The quantity of ammoniacal liquor produced by scrubbing materially increases the revenue from the secondary products. Some gas works are still without any provision for extracting ammonia, while good and sufficient apparatus is employed in others. As the total expenses of erecting such appliances might be repaid in the course of from three to six years, it is surprising that scrubbers are not more generally adopted.

The cost of purification varies in different works. Material and labor, where lime is used, is found to cost about 1d. per 1,000 feet made; from 4 to 5 million feet of gas being passed through each purifier before changing —that is, when using a range of four purifiers. It now appears to be ascertained that it is better to place the lime on one or at most two tiers of sieves, than spreading it thinly on three or four. When one tier in each purifier is used, the lime is from 24 to 30 inches thick; with two tiers it is from 10 to 12 inches thick. By this means back pressure is reduced to a considerable extent. When the lime is properly worked, it should be taken out of the purifiers in a solidified state. I have not mentioned oxide of iron, as it is not in general use; but it appears it is used with advantage along with lime. If those who treat it in this way were to give their experience, it would prove of benefit to the members.

Although the station meter is an instrument made for correct measurement, it surely is not in true working order in some works, as the production per ton of coal carbonized varies so much, even where it may be supposed the same class of coal is used, and equally good work done in the retort house. At best the make per ton ought only to be taken as a relative, and not as an actual quantity. Some station meters may be too small for the work to be performed, and so be over-driven, which may partly account for the difference in registration. More stress ought to be put on the quantity sold per ton, as the measurement at consumers' meters is the real test. It appears better work to produce 11,000 feet per ton and sell 9,000, than it does to make 10,000 and sell 9,000, the result being the same in the end; but the party who produces the greater quantity is generally credited with the better management. The leakage in the one case is about 18 per cent., while in the other it is 10 per cent. The reduction of leakage ought at least to be held of as much importance as a great production per ton.

The foregoing are only a few of the examples of the variations of the mode and cost of working, but I think they are sufficient to show that very great improvements might be effected in many gas works.

No notice has been taken of the proportions and kinds of condensers and other appliances, but enough has perhaps been said to attract the attention of members to the variations in the working results obtained. In other manufacturing trades the aim is to get the greatest returns for the smallest cost of raw material and labor, and this being held as a true commercial principle, it ought to be steadily kept in view in the process of gas manufacture.

I presume each one is most willing to assist his neighbor, and in the case of those who are getting inferior results, they should consult their brother managers, as by this means they might be able to put their works in a more satisfactory state. There should be no exclusiveness, and no secrets, so called, as to how each manages his works, and it would greatly tend to the benefit of all if more opportunity were taken of free intercourse and interchange of opinion with each other. Our yearly meetings afford little scope for full discussion and full statistics being given on all the points indicated; but if each were to fill up certain forms giving the various detailed workings and their results, it would help in a great measure to further the interests we all have in view—viz., the bringing to the greatest state of perfection the industry in which we are engaged.

DISCUSSION.

Mr. Robb (Haddington)—This is a most important paper, and one which ought to receive the attention of all. I have been very much interested in the discussions which have taken place since Mr. Scott, Jr., read his paper before the West of Scotland Association, and I have had the curiosity to go over the circulars containing the analyses of coal which have been sent to me for the past 30 years. In one word, I may state that I have 116 analyses of parrot coal, yielding above 10,000 cubic feet of gas per ton, the average being 11,392 cubic feet; and that I have 44 analyses yielding less than 10,000 cubic feet per ton, the average being 9,383. Adding the two together, we get an average of 10,387 feet. Looking at these figures, and comparing them with the yield in actual working, I find in Dundee that they get 11,394 cubic feet per ton, which is a little over the figures in my possession. In Galashiels they get 10,307 cubic feet per ton, and in a small works making 6 millions—that is, Innerleithen—they got 10,250 feet. Dividing these results by three, we find that 10,650 feet is the yield of gas per ton in practical working. I do not know how those people who find fault with chemists for supplying their analyses can, in the face of the figures I have quoted, justify or reconcile their statements. I find that the chemists are not at fault. The fact is we are getting more than we are told we shall get out of the coal. I trust that some young man will investigate this question and give us a paper on the subject at our next meeting.

Mr. Young—Perhaps Mr. Robb will kindly mention what he gets himself.

Mr. Robb—I am enthusiastic in some points, but really I am not so enthusiastic as to state my own results.

Mr. Miller (Innerleithen)—Mr. Robb, in his statement, has mentioned three towns, and he states what they get per ton at the station meter. I have 10,250 cubic feet per ton at the station meter, and I am paid for 9,060, which gives a leakage of 11 per cent. Mr. Terrace spoke about the varying of the station meter, but the results I have stated show that my station meter must be nearly correct. I am not quite at one with him as to the lime being put on sieves 15 inches thick. I have tried it. It is all very well if you have an exhauster to draw or force the gas through, but if you have not an exhauster you will not be able to put it through 15 inches of lime on each sieve.

Mr. M'Gillivray—I think we ought not to let this matter drift into how much each individual manager can take out of a ton of coal. We should view the subject from a broader point of view, and turn our attention to the important points—the amount obtained per ton, the amount sold, and the passing of the gas through a thick layer of lime. These are matters with respect to which we only arrive at conclusions by practicle experience; but I think it is a fallacy to compare one works with another, or one manager with another, on these points. My reason for saying this is simple and obvious. Every district is surrounded by circumstances which regulate the supply, and which are peculiar to the situation of the district. In one town you may find a number of meters on the main, and leakage might be small, and in other towns, with a lesser number of meters on the main, the leakage might be large. These and other matters can afford no criterion as to the results obtained, unless we have the actual leakage stated in each case. Then, as to the hints about the lime, I can scarcely agree with Mr. Terrace. I cannot see how gas can be forced through lime 30 inches thick.

Mr. Esplin—This paper shows that Scotch gas companies should give greater attention to one feature of the manufacture—that is, the commercial value of the residuals. I gather from a speech made by Mr. Woodhall that the total cost of coals per ton at his works averaged 13s. 6½d., and he realized 10s. 4½d. from the residuals last year. That is a price which perhaps we cannot expect to obtain; but there cannot be the slightest doubt that a

greater revenue ought to be derived from the sale of residual products, and on this point I strongly indorse what Mr. Terrace has said.

Mr. Whyte (Seaham Harbor)—I think that it is most unfair to give a manager credit for good management because he happens to get 10,000 or 10,500 cubic feet of gas per ton of coal, since it may be that his neighbor, who is getting only 9,500, may be the better manager of the two. We do not know all the circumstances relating to the individual cases, and circumstances alter cases everywhere. Then, again, it is not the manager who shows the least leakage who is in the best position. I know a place where the manager cannot produce more than 7,000 feet per ton at the consumer's meter, yet in the circumstances he is perhaps as successful and as good a manager as his nearest neighbor, who may be measuring 10,000 feet. It depends on the different circumstances of the works.

Mr. Hislop—I have only one or two remarks to make in connection with this subject. We are certainly indebted to Mr. Terrace for introducing it. I would observe that the indication of gas made at the station meter might be the result of a defect in the condensing apparatus, or it might be due to the purifiers, etc., being too small, because, where the gas is forced through with considerable velocity, the friction tends to raise the temperature of the gas; but in those cases where it is measured at the high temperature, the leakage will necessarily be large, and therefore the one thing will be a check on the other. In reference to the thickness of the lime. I do not quite agree with Mr. M'Gillivray. For many years, in my earlier experience in gas management, I used to employ four trays of lime in the purifier, but for some time I have abandoned that method of working, as experience has taught me that so many trays in a purifier tend very much to increase the pressure. In practice, therefore, I never put more than two trays of lime or oxide of iron into a purifier, and I find that the pressure is greatly reduced. If the lime is properly prepared, too, I am certain that there will be less pressure than by introducing lime in solid pices into the chamber. I find no difference in pressure with 18, 20, or even 30 inches of lime. I have advised other managers to try this plan, and they have considered it an improvement. Lime, to be in proper order, ought to be prepared a week before it is put into the purifier, and it is a mistake to put in lime recently slaked with water. If prepared a week before being used, it ought to be in good order; but if the particles adhere they can be easily broken down. If the lime is prepared in this way, I do not care what thickness you have on the trays, you will undoubtedly have a reduction of the friction caused by the passage of the gas. In practice I only use one tray of oxide of iron, and when it is slightly mixed with sawdust the resistance I find to be very small. The thickness of the lime and oxide varies from 24 to 30 inches. In reference to analyses, I believe it will be found that the deficiency arises from the second and third class coals used. These contain a large proportion of water, and undoubtedly they will not give the same results, by a long way, if immediately on their arrival at the works they are applied for the production of gas. You will readily understand that when I state that some of these coals contain twelve per cent. of water, I find within certain limits that the percentage of water will affect the results by five per cent. In comparing these results, therefore, care should be taken to see that the conditions named in the analyses are the same when the experiments are made, and only then can a proper comparison be made as to the results obtained.

Mr. Mitchell (Dundee)—It is no part of the object of this Association for any one to come up here and say, "I can do so and so at my works." We should distinguish ourselves from the general public. The public, as you all know, are apt to be misled by the quantities of gas registered at the station meter; but we are expected to know better. Some people go to the length of expecting a uniform price for gas in Scotland and England. They do not know that gas is much superior in Scotland as compared with England, but they draw comparisons, and say that the price in the one country is double that in the other, while they ignore the fact that in the one case there is double the amount of light. In receiving statements as to our working details, however, we do not require to be under the same influence. Now, suppose we hear of a works producing a large quantity per ton, we need not rush to the conslusion that something is wrong with the station meter, or that the leakage is higher there than in other towns. We know quite well that the practical results, so far as pounds, shillings, and pence are concerned, is the quantity passing through the consumers' meters. Again, although we understand that in a certain town the quantity passing through the the consumers' meters may not be larger than in another town where the make is less at the station meter, we need not rush to the conclusion that the station meter is wrong in the town which gives the large make per ton at the station meter. The one thing has nothing to do with the other. There may be a large make at the station meter, but a larger number of main and service pipes in one case compared with the other, and this may account for the leakage. Mr. Terrace also made reference to the use of lime and oxide, and if any information I can give will be of advantage, I will give it. In Dundee our purifying apparatus consists of two sets of purifiers 20 feet square by 4 ft. 6 in. deep, worked by centre-valves, three in action in each set. In the lower tier we use lime about 6 inches thick; in the second tier we use oxide from 8 to 10 inches thick; and in the third tier oxide about 8 inches thick. If I had had the balance sheet, I should have been able to show the figures relative to the purifying arrangements for the year, but I do not have it. I may say, however, that since we began to use oxide in a systematic way, the saving effected last year over previous working was to the extent of from £300 to £400. That is brought about by merely using oxide in place of lime. We have a revivifying arrangement for the oxide, so that we can now make a better use of it than formerly; and then we have a labor-saving apparatus for lifting the oxide from the purifiers and spreading it on the floor of the revivifying shed, which is 14 feet above the purifiers, where, from its exposed position, the oxide is revivified to a greater extent and more safely than when spread on the ground in an adjacent shed.

Mr. M'Gilchrist—I think the make per ton is a false basis to go upon. The consideration ought to be, What is the cost per ton?

The President—I do not think we need go into that again.

Mr. Mitchell (Coatbridge)—I beg to move a hearty vote of thanks to Mr. Terrace for bringing the subject before the meeting.

Mr. Young—With all deference to the Chair, I think it would be advisable to allow the discussion to proceed.

The President consented.

Mr. M'Gilchrist proceeded: The question we have to deal with is not whether we make 11,000 or 6,000 feet—it is what it costs per 1,000, and the manager who makes gas at the lowest rate per 1,000 is perhaps not the most successful. Then, in regard to the setting of retorts, I think this would form the subject of a good paper at our next meeting, because there is no part of our apparatus in which there is so much diversity of opinion as in the setting of the retorts; and, curiously enough, it is the most important part of our apparatus. In Dundee, where the make is perhaps the highest per ton, they have only one furnace to three retorts. In Edinburgh and Leith they have two furnaces to five retorts; in Greenock they have two fires for five large D retorts; and in Coatbridge, one of the most recently erected works, they have an excellent setting of five retorts to one furnace. If Mr. Mitchell can heat his five retorts with the same amount of fire as three retorts in other places, this is undoubtedly the best arrangement. In reference to the scrubber, I know works where within the past year a scrubber was erected, and in one year they were able to pay more than the total cost of the whole scrubber, in this way not only bringing profit to the company, but securing to the public gas free from ammonia—a most desirable consummation.

Mr. Scott (Falkirk)—Mr. M'Gilchrist, in the course of his remarks, said that the manager who makes the gas at the cheapest rate per 1,000 feet is often not the most successful. In dealing with that question I think we ought to take into consideration the peculiar circumstances of each particular case.

Mr. M'Gilchrist—In considering this question no doubt we must take into account the cost of the raw material as delivered into the retort house. If one pays 20s. in his works, and another 15s. for the same coal, it is clear that the latter has an advantage to the extent of 25 per cent. But it is the principle of the thing that I am thinking of.

Mr. Young—We have to thank Mr. Forstall, of New Orleans, for the discovery that layers of lime can be used to a great depth without bringing about any great resistance. He said that it could be used from 30 inches to to 36 inches in thickness without much resistance being experienced I can corroborate this statement. In Clippens, at the present moment, we use something like 3 feet of material in removing the sulphur compounds. In regard to the production of gas from the coal, that very much depends on the locality of the works. There are many matters of detail which come into consideration, and which render comparison difficult.

Mr. Terrace—I should like to ask whether there are three or five retorts to one furnace in Dundee.

Mr. Mitchell—I may say in Dundee we built an oven of five retorts and one furnace as an experiment, and we had it working for the greater part of the season, and I may say in a word that a saving of thirty per cent. of coke was effected by having five retorts in one oven as compared with three.

The President—We are much indebted to Mr. Terrace for his excellent remarks, and, as our time is now exhausted, I think a committee should be appointed to revise the report of the proceedings.

A committee was accordingly appointed.

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An Important Discovery has been made in Japan. We learn from the newspapers of the capital that a citizen of Hizen, named Miné, has discovered a fine coal deposit at Nakashima, in Nagasaki Ken, and has received a loan of Yen 150,000 from the Government to assist him in developing it. Rich results are expected from the operations.

[From the "Gas Trade Circular and Review."]

## Gas Undertakings and the Electric Light.

We extract the following letter from the Manchester *Evening News*:

Sir—I regret that I should have occasion to differ with many of the remarks contained in a leading article of the *Evening News*, treating of gas companies and the electric light. The tendency of such statements, if left undisturbed, is bad, and especially so in the present instance, for under a show of encouraging and assisting the progress of scientific discovery and improvement, the claims of justice and truth are entirely ignored. The writer expressed the belief that "gas undertakings are unlikely to be of much service a few years hence." Has he given the slightest consideration to the result which would ensue supposing his prognostication to be fulfilled? At the lowest computation there is expended on gas undertakings in the United Kingdom alone no less a sum than sixty million pounds, representing an investment of at least one hundred and ten million pounds sterling; the shares or stock to that amount are held principally by the middle classes of the community, and are a measure of the thrift and self-denial of which we as a nation are justly proud. A large proportion of the investment is in the hands of, or in trust for, spinsters, widows, minors, and aged persons, whose whole or chief means of subsistence is derived from the interest they thus receive. The result of gas works becoming useless in a few years hence would be to plunge vast numbers of the most deserving of the population in penury and distress, and this surely, even if the interests of science demand it, would be a matter of deep commiseration. But there might be some show of justification for even such a calamity as this, if it could be proved that gas directors and officials of gas companies as a whole are the grasping and unscrupulous knaves they are sometimes represented to be. Take the metropolis as an example, the gas companies of which the writer of the article holds up to scorn and contempt. "The metropolis," he says, "is placed in a miserable position as regards a supply of gas, and before long public indignation may rise to such a height as to render it necessary to take the illumination of London out of private hands." I deny the preposterous charge, and challenge the writer to make good his assertion. The gas supply of London is of the most ample and generous character. In this respect, as is well known, it is one of the wonders of the civilized world. The gas referees of the metropolis, Professor Tyndall, Dr. Pole, and Mr. Vernon Harcourt, who are appointed by the Board of Trade, are men in the foremost rank of science, and they certify week by week, through their examiners, that the illuminating power, purity, and pressure more than conform to the acts of Parliament by which they are regulated. The purity clauses in the London Gas Acts are the most stringent in existence; in no provincial or foreign town is anything like the same surveillance exercised. Does the writer of the article refer to the illumination of the streets? Then he is surely unaware that the public lighting is managed and controlled by the corporation and the vestries, and all that the companies are required and permitted to do is to furnish the necessary quantity of gas of a given illuminating power, whilst the size and number of lights in the streets are matters over which they have no voice, and are not allowed to interfere. In all vast industrial enterprises there will arise occasional causes of distrust and disagreement, but taking gas undertakings all round, whether in the hands of corporations or companies, they are not excelled in their management by any other industry in existence. Of the London Gas Engineers (and they, after all, are the responsible purveyors of the gas of the metropolis) I can say from personal knowledge, and without fear of contradiction, that they are men who, for ability and integrity, are an honor to their profession. But what has all this to do with the electric light? Surely we can be shareholders and gas employees, and even gas directors, without being inimical to the progress of science. That the electric light will eventually supersede gaslight is, in the absence of the prophetic faculty, a mere matter of opinion. I am of opinion that it never will, either for general or domestic lighting, and have elsewhere given substantial reasons for my belief. The electric light has its uses, but they are in no way antagonistic to those of gas light. The writer of the article quotes the illuminating of Billingsgate Market as a successful application of electric lighting. He could not have selected a worse example, for after repeated trials the light there was condemned on every hand, both by dealers and customers, and was almost angrily hustled out of the place and the familiar gaslight reinstated. Again, the writer is quite beside the mark in his statement "that one of the largest gaslight and coke companies in London has obtained powers to illuminate the metropolis by electricity." The truth is, that of all the gas companies in Parliament during the year, not one of them had powers granted for supplying the electric light, although it would, in my opinion, have been altogether in the interest of science if they had. The Liverpool Corporation obtained powers to experiment upon and use the light under certain restrictions, but it is safe to predict they will never take advantage of the powers granted to them. Private enterprise alone can be trusted to undertake work of this kind, and we have private enterprise to thank entirely for the cheap and abundant blessing of gas light.

THOMAS NEWBIGGING,
Pres. Manchester Dis. Inst. of Gas Engineers.
—5, *Norfolk street, Man., Aug. 18th*, 1879.

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The *Jounral of Gas Lighting* comments as follows on the article referred to:

In the Manchester *Evening News* of Monday, the 18th inst., an article appeared which displayed, if anything, rather more than the usual amount of ignorance of facts observable when writers in the general public press treat of special subjects—such as gas supply. For instance, the writer of the article referred to says: "One of the largest gaslight and coke companies in London has obtained powers to illuminate the metropolis by means of electricity," which is not a fact. He then goes on to remark: "Nothing much has been done as yet; but it is a significant sign of the times that such should be the case." A quotation follows from a London daily newspaper report of the speech of the Governor of The Gas Light and Coke Company at the half-yearly meeting of shareholders held on the previous Friday, when, referring to the improved system of street lighting carried on at the expense of the Company, he said: "It is now proved that if the public like to pay for it, we can give them a better light than the electric light will be, and at a very much reduced price." On this the writer remarks: "The views expressed by the Hon. Richard Howe Browne strongly suggest the idea that he is not entirely unacquainted with the adage, 'There's nothing like leather!' It would be difficult for the chairman of a gas company which, in bad times, pays 10½ per cent. to see anything through the medium of the electric light. And yet the efforts made and the powers acquired by the Company are calculated to excise doubts, if not of the sincerity of the belief expressed, at least as to the wisdom of the conclusions upon which it is based. It is absurd to suppose that the question can be shelved, or that scientific research should fail to discover means whereby electricity may be turned to further account in the interest of mankind. The world continues to move, whatever prejudice and self-interest may assert to the contrary."

It would be difficult to find more misstatements and misrepresentations in any column of type than appear in the article in question, and it must be viewed as a lamentable circumstance that the leading columns of a newspaper having the wide circulation of the Manchester *Evening News* should be open to writers displaying so much ignorance of the subject of which they treat.

Mr. Newbigging, however, in a letter which appeared in the *Evening News* the next day, ably replied to the article; and it would be well if gas engineers and others throughout the country, following his example, would make a point of writing and setting the true facts before the public, when remarks calculated to convey so erroneous an impression as the ones we have referred to are published in local newspapers.

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[From the "English Mechanic."]

## The Light and Energy of Electricity and Gas.

BY J. T. SPRAGUE.

Some very remarkable statements were made before the Committee of Parliament on Lighting by Electricity. These statements are embodied in the report, and having gone the rounds of the press without examination or comment, they will, no doubt, be adopted as settled facts. It is therefore very desirable that they should be examined, and that an understanding should be arrived at as to how far they are reliable, and in what sense they are true. We will therefore commence with the remarks of Sir William Thomson.

1746. We are anxious to obtain your opinion upon various points connected with electric lighting; perhaps you will let me go to the root of the matter, and ask you to tell us the energy which is used and exhibited as light in the production of the electric arc?—The energy which is actually used in the electric arc is about 1-horse power per 2,400-candle power, or even more than 2,400-candle power, according to the dimensions and other circumstances of the electric arc.

1747. That is to say, 1-horse power, if fully employed, produces 2,400 candles or more?—Yes; 1-horse power actually in the electric arc; 1-horse power spent in stirring the luminiferous ether between the carbon points and on the surfaces of the carbon.

1748. Have you at all calculated the energy appearing as light in the case of the combustion of gas?—One-horse power of energy in the combustion of gas produces about 12-candle power.

1749. And 1-horse power converted into electric light produces 2,400 candles?—Yes.

1750. As these are rather startling figures, perhaps you will explain to the committee how you arrive at such results?—Sir William's reply is too

lengthy for full quotation, as the greater part of it is unimportant. He concludes by saying: "The upshot of all is that, allowing the practical estimate of 1-horse power actually spent in driving the engine to produce 1,200 candles, which has been realized, I estimate that one-half of that power goes to the electric arc, and one-half is lost in heating different parts of the machine. This, then, gives 2,400 candles for 1-horse power, which is the figure of my answer. In respect to gas, I have taken 4 candles per cubic foot of gas per hour. I have taken the heating power of gas at 12,000 centigrade units per gramme; I have taken the specific gravity of the gas as half that of air, and calculated accordingly. I have thus calculated the whole heat of the combustion of gas, from the amount of that per second of time, and reduced it to horse power. Thus I arrive at the figure which I gave in my answer—that is, 1-horse power actually spent in warming the air and stirring the luminiferous ether in a gas flame of 12-candle power."

The committee in their report remark that there is some difference of opinion between the scientific and practical witnesses, and it is not to be wondered at, if the foregoing is to be taken as a type of scientific evidence. In fact, the statements are all true, but they are so arranged as to constitute a complete chain of special pleading, and to convey an absolutely false impression of what the facts themselves really mean. The statements are true as to the energy actually in the lights. The impression they produce is false as to the energy necessary to produce the lights.

There are two ways of considering energy, as with most things. There is the potential or theoretical energy of a combustible; that is to say, the total heat capable of being produced by its union with oxygen. The potential energy of coal, for instance, is about 13 centigrade heat units per pound. In commercial language, we may call this the gross energy of the coal. There is, again, the practical energy of the combustible, a function of the boilers and engines. For instance, average steam engines give a horse power for seven pounds of coal per hour; this, in commercial language, may be called the net energy of the coal.

Now, what Sir William Thomson has done is just this: he has charged the gas light with the gross energy, and the electric light with the net energy, and people who do not understand this, like the writers in the daily press, of course imagine that these figures, so seriously stated, are really true.

Now let us see what would come of an equitable comparison, using, as far as possible, Sir William Thomson's own figures.

One-horse power is 33,000 ft.-lbs. per minute, or 1,980,000 per hour. Expressed in heat units of 1 lb. water 1° Cent., which equals 1,390 ft.-lbs., 1-horse power per hour equals 1,424.5. This, then, is the potential energy of the 4 cubic feet of gas, giving 12-candle light.

To put the 1-horse power of energy into the electric arc another 1-horse power is of necessity expended in the circuit, and must be charged, because the gas compared with it is the whole amount necessary. But to produce 1-horse power in a steam engine involves a consumption of coal varying from 2.5 pounds, in the most perfect and expensive engines known, to 8 and even 10 pounds in common engines; let us take 4 pounds as a very fair engine's work, and we have 8 pounds of coal expended in generating the 2,400 candles mentioned. Now, the potential energy of 1 pound of averge coal is 13,000 heat units, or, in 8 pounds, 104,000.

Instead of having the energy per candle:

| | |
|---|---|
| Gas | 1,424.5÷ 12=118.7 |
| Electricity | 1,424.5÷2,400= 0.597 |

This being what Sir William Thomson makes it appear to be, we have, by equitable comparison:

| | |
|---|---|
| Gas | 1,424.5÷ 12=118.7 |
| Electricity | 104,000.0÷2,400= 43.3 |

Even then we have omitted a very important element of consideration: the gas light needs no machinery, no capital outlay, no skilled attendance; the electric light wants all these, and if they do not form an element of the scientific calculation as to potential energy involved in the two cases, they enter very largely as factors in the practical calculation as to the potential cost. Hence the difference in the practical and so-called scientific opinions noted in the committee's report.

The comparisons made are, however, intrinsically erroneous, because made between electricity in its best conditions on the large scale, and gas in its worst on the small scale, and it is well known that in all things the small scale is most costly, whether we consider the expenditure of money or of energy. But, in addition to this general principle, the comparison is not really made with an electric arc having 1-horse power of energy expended in it. The estimate is made from a light having 3 or 4-horse power in it. In this way the value is arrived at "of 1-horse power actually employed in driving the engine to produce 1,200 candles," and as only half this energy is in the arc, the light equal to 1-horse power is taken as 2,400; but it is well known that to produce a light of 1,200 candles in a single arc requires 2-horse power of engine, and in those conditions the 1-horse power energy would be actually in the arc, and the efficiency would be:

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|---|---|
| Electricity | 104,000÷1,200=86.6 |

as against gas 118.7 per candle, and this when setting the production of a 12-candle light against one of 1,200.

It may be well to explain why the actual energy expended in the luminous area is so much smaller with electricity than with any combustible such as gas. In the case of combustion the energy has to be employed in heating the products of the combustion, steam and carbonic acid, and a large bulk of neutral nitrogen from the air; these all flow rapidly away and carry off the heat. The very same loss has to be met in the electricity when derived from combustion, but the loss occurs, not in the light, but in the furnace and in the wires; here pure energy is collected and transmitted to the arc, where it makes its appearance as light unencumbered by the products of the processes of the transformation of latent energy into light and heat. Still, as the loss has to be incurred in both cases, both the lights when compared must have the total energy needed for their development taken into account.

The same witness expressed opinions as to the transmission of power from central engines to different parts of towns by electricity, but as Mr. Siemens gave the figures upon which these opinions are founded, we may now pass on to examine these. Mr. Siemens, comparing the cost of gas and electricity, says: "(136). Making the unit of comparison 1,000 standard candles per hour, the results are striking. An Argand burner produced 1,000 standard candles of light per hour, with a consumption of 312.5 cubic feet of gas; and to make this, 56 pounds of coal would have to be used in the retorts. (139.) In the case of a medium dynamo-machine driven by a gas engine, 19.5 cubic feet of gas produce 1,000 standard candles during one hour; and the consumption of coal necessary to produce this gas is 3.26 pounds. (141.) And in the case of the naked light the consumption of coal is very nearly the same?—It is very nearly the same; it is 13.3 pounds in the gas engine, and 12 pounds in the steam engine, showing that the gas engine is really a very economical engine, and has, moreover, the advantage over the steam engine, that no boiler is employed, and that the consumption of gas commences and ceases the moment the motion of the engine commences and ceases."

It will be seen presently that this advantage of the gas engine is very much understated, because the coal corresponding to the gas is largely overestimated.

The comparison between the relative weights of coal consumed is really of little importance, because the real thing to be considered is the relative costs. The cost of gas is, of course, greater than that of the mere coal it represents, because its price includes labor, capital, and distribution; on the other hand, the coal consumed in the other case must be charged with wages, etc., necessary for its consumption to place it on the same footing as the gas with which it is compared. But when any comparison is made, or any line of argument adopted, it ought to be correctly worked out.

Now, instead of an Argand burner giving the light of 1,000 candles on a consumption of 312.5 feet of gas per hour, this value is calculated from the work of 62 Argand burners, each consuming only 5 feet per hour of 16-candle gas. No burner of 1,000-candle power has been made. But burners giving 250 candles, on a consumption of 50 feet, are made, so that we know that 1,000 candles can be obtained from 240 feet, instead of 312.5. But Mr. Siemens commits a more serious injustice when he charges against the gas the whole of the coal put into the retort, allowing nothing for the coke and tar, which form part of the actual coal with which he is comparing the gas. In this way he obtains a consumption of 15 pounds of coal per hour with gas, as against 8 pounds consumed in a steam engine to develop the 2-horse power necessary to develop 1,000 candles in one electric arc.

A ton of average coal gives 9,600 feet of gas of 0.450 sp. gr., which equals 331 pounds of purified gas per ton; about 1,300 pounds of coke is produced, and if we reckon the excessive consumption of one-third of this in the furnaces, and charge the whole of this against the gas produced, we shall find that we get about 12 feet of gas for each pound of coal which has disappeared—that is to say, 100 cubic feet of gas represented, at most, 8 pounds of coal. This reduces Mr. Siemens' 56 pounds per 1,000 candles to 25 pounds on the consumption of 5 feet Argands, and to 19 pounds on the actual consumption in 4 of the 250 candle burners.

This shows the great economy of the gas engine as compared with the steam engine. Gas engines are already in use which develop 1-horse power per 21 feet of gas, which represents at most 1.6 pounds of coal, and this efficiency is realized in small engines. But the very best steam engines of large dimensions have never realized more than 1-horse power for 2.5 pounds of coal, and this only with great attention. Ordinary engines consume 8 and 10 pounds per hour per horse power, and a consumption of 4 pounds would be very good work for any engine employed under general

conditions analogous to those for which gas engines would be used. The reason of this economy is that the potential energy of the fuel is converted into mechanical energy in the cylinder by the act of combustion; only so much is necessarily carried off as goes with the heated products containing only the small quantity of vapor due to the hydrogen in the gas. With steam all this loss occurs in the furnace of the boiler, and in addition there is the immense quantity carried off in the escaping uncondensed steam.

We now come naturally to the question of transmitting power. Mr. Siemens says: (200.) "I believe it would be the cheapest mode of transmitting power to a considerable distance. The experiments which we have made give a result of a loss of 50 per cent., that is to say 5-horse power applied to a dynamo machine produces, roughly speaking, 2½-horse power at a distant point; it would follow that, say, a 100-horse power engine at a central station, which could be worked with a consumption of 2.5 pounds per horse power, would produce at a number of points, power at the rate of 5 pounds per horse power."

Mr. Siemens thinks more favorable results may be hoped for than 50 per cent. return; but it is a pretty general law in electricity that the resistances must be equal in generator and utilzer, and there are reasons for this, which the resistance expresses, though it is itself an agent and not the cause; hence, 50 per cent. is the full theoretical efficiency, allowing nothing for loss in the conductor and by leakage. In actual working the total efficiency would be more likely 30 to 40 per cent.

But giving electricity its utmost claim, and the use of the best engines known, we have a consumption of coal of 5 pounds per horse power delivered, as against 1.6 pounds per horse power as delivered by gas. But we have to consider something besides the theoretical consumption of coal. The 21 feet of gas at 4s. per 1,000 costs 1d., while 1d. would buy 9.3 pounds of coal at 20s. per ton. But the 1d. in the case of gas covers the whole cost of the delivery of the energy of the coal to the machine which uses it. In the case of coal it represents, on the other hand, energy which has to be delivered; to place the electric energy of that coal on a par with the gas we have to provide and pay for:

1. The capital outlay, wear and tear of the steam engine, and its attendance.

2. The dynamo machine which generates the electric current, and all its subsidiary expenses.

3. A conducting system, the conditions and difficulties of which are as yet absolutely untested.

4. The general expenses of management, and the profits of the undertaking.

These simply represent the gas works and mains, and the expenses and profits of the gas company, all of which are included in the penny charged for the horse power of gas. The consumer would have in either case to provide a gas engine or dynamo-electric apparatus, the cost of which would be about the same.

It is quite certain that the expenses of all this would raise the cost of the 5 pounds of coal consumed at the central station to considerably more than the penny; in fact, they would be so great that it is not surprising that no one has yet ventured to dispute the remarks made some time ago on Mr. Siemens' proposal to transmit the energy of waterfalls 30 miles distant, or of the coal at the pit's mouth. The power costing nothing at the 30 miles distance, it would be better economy to allow it to run to waste; its delivery would cost more than the expenses of the carriage of coal, which has to be paid for, and its conversion into gas in the different towns as required.

As the writer himself is working at the problem of electric lighting, and is the patentee of machines which will be brought into operation in a little while, it will be understood that there can be no intention to depreciate the importance of these applications of electricity. But the statements examined will no doubt be utilized ere long by the various prospectus writers, who are waiting their opportunity; and it is of great importance that their actual meaning should be understood and the real truth be presented to the public understanding.

## Revival of Prosperity in Boston.

One of the most gratifying indications of the revival of prosperity in Boston is seen in the increased demand for houses. There are very few desirable houses to rent in the city to-day. Those that may be obtained are mostly confined to buildings badly put up, imperfectly drained, or having the drawback of some other imperfection. A leading house broker remarked the other day that he had applications constantly that he could not respond to, and that from present indications there would soon be need for the erection of many new buildings for family occupation. This, too, it is to be remembered, is in the face of the fact of large numbers of apartment houses that have been added to the accommodations of the city, in which people live in flats. The increase of these has been seen in all quarters, and in some instances store property has been changed in its upper stories for this use. Another symptom here for congratulation is in the proof which it affords that families ara coming back into the city that formerly lived outside its limits. Boston is gaining all the time in this way. She has still a redundancy of stores, but with the promised accession of business it is not unlikely that these may come into use also, though it will be a long time before anything approximating to the old prices for store rents is reached, if it ever is again.—*Boston Saturday Evening Gazette.*

[From London "Journal of Gas Lighting."]

## The Gaslight and Coke Company.

The Half-Yearly Ordinary General Meeting of this Company was held at the Office, Horseferry Road, Westminster, on Friday last, the Hon. Richard Howe Browne, the Governor, in the Chair.

The Secretary (Mr. J. Orwell Phillips) read the advertisement convening the meeting. The corporate seal of the Company was then affixed to the register of Proprietors; the minutes of the last half-yearly meeting were read and confirmed; and the report and accounts were taken as read.

The Governor—Ladies and gentlemen, in rising to propose the reception and adoption of the report and statement of accounts, I am happy to be able to say that it will not be necessary for me on the present occasion to detain you for any great length of time. The current of events in this great company has flowed so smoothly and uninterrupredly during the period which has elapsed since we last met here, as to render it unnecessary for me to enter into many subjects which at other meetings it has been my duty to refer to. I would first of all call your attention to the accounts which have been in your hands, and I hope that you will concur with the Directors in expressing your satisfaction at the results of our half year's working, and with the accounts that have been presented to you. In the first place, we have been enabled to maintain our dividend, as well as carry over an amount of undivided profits When we look around us throughout the whole of England, and throughout the whole Continent, we cannot fail to observe the very serious depression in trade which has existed now for four years. Looking especially at the iron trade, the coal trade, and the corn trade—and to these I must now, unfortunately, add the agricultural interests of the country, which are suffering from very great depression—looking to all this we must congratulate ourselves that we are able to come before you to-day maintaining the same dividend as we paid last half year, and, at the same time, giving you, in other respects, so very favorable an account of the proceedings of the company. I may explain now the reason why our accounts this half year are not within a very large amount so favorable as they were in the corresponding period of 1878. We have had the greatest possible difficulty in disposing of our coke. The diminution in the sale of coke, as compared with this time last year, amounts to no less a sum than £33,000. Another bad feature in our accounts—and it is completely beyond the control of the Directors to regulate it—is the diminution in the amounts received for other products—tar, for instance. We have realized a loss upon tar to the extent of £17,000 during the half year, and this, with the other sum I have mentioned, will amount to £50,000 in the half year. In addition to this, gentlemen, I have to recall to your remembrance the strike which took place in the Durham coal-fields during the period at present under consideration. It has cost us no less a sum than £16,000. Massing the whole of these losses together, the extraordinary loss of this half year amounts to upwards of £66,000, which represents a very large dividend upon the entire stock of the company. Those matters, gentlemen, are entirely beyond our control. We were obliged during the strike, not like smaller companies, who could supply themselves from the open market, and get a cargo of coal here, and a cargo of coal there—we were obliged to have a large stock of coal on hand, because no one knew how long the strike would last. In default of our contractors supplying us, we were obliged to purchase from other parties 70,000 tons of coal, which did not turn out so good as we were in the habit of having: there was a consequent loss upon that transaction, both in the amount of gas produced by the coal and as regards the residual products derived from it. I will now say a word or two as to our new works at Beckton for manufacturing the residual products. These works are in full operation as far as the requirements of the company go. By-and-by, when the winter comes on, they will be much more extensively employed; and the opinion of the Directors is that, as far as the speculation has gone, it is eminently successful in every possible way. We are now working very large quantities of tar and ammoniacal liquor without hearing the slightest complaint of our having caused any kind of nuisance, which some parties apprehended would arise. We have carried on the works up to the present moment without complaint from any one in the neighborhood. We are turning out an excellent sulphate of ammonia, and a large quantity of anthracene, creosote, and so on. I hope to be able to show you by the printed accounts when we next meet, that our investment in this direction has been and will be a very profitable one indeed. I have myself lately been

down at Beckton, and I was delighted with the manner in which everything was being conducted at our new works, and this is saying a great deal for operations that have been undertaken by this Company for the first time. You are all aware that a Committee of the House of Commons has during this session been inquiring into the electric light question. That committee came to no very definite conclusion, and made a report which might be read in half a dozen different ways. However, they decided that certain powers which were asked for in some of the bills then before Parliament should not be granted, and there at present the matter stands. The Metropolitan Board of Works appear to have adopted the electric light in their board-room at Charing Cross; but I think they will very soon get tired of it. There is not the slightest doubt in the world that the electric light contains matter which is injurious to the sight and to health. I have seen this proved myself. Since we last met, the Thames Embankment has been illuminated by the electric light, and the lighting has been more satisfactory than it was during the first experiment; it has therefore been extended by the Board of Works, I believe, for some months longer. But even in its improved condition, the electric light is not one on which you can always depend. On several occasions, even within the last three or four days, the light on the Embankment has partially gone out, and our assistance has been obliged to be called in to give the necessary illumination. However, the Directors have not changed their opinion as to the danger or the possibility of the electric light interfering in any way whatever with the general business of this Company. From the first time I saw the apparatus in Paris, 18 months ago, I was fully convinced that it was not an application that could be made successfully with profit as superseding gas lighting in general. You are aware that during the last half year we have demonstrated to the public a process of lighting by gas which, of course, although more expensive than the old system of lamps, is very effective as far as the light produced is concerned; in fact, it is more effective than the electric light. Any gentleman who may wish to see the light may do so at the foot of Westminster Bridge, where it is in direct contiguity with the electric light, so that he will be able to judge for himself. There is a light there that completely excels the electric light in the intensity of its illumination and in the scope of its diffusion. Queen Victoria Street, in the City, is now being lighted with improved lamps on Mr. Sugg's system. The lamps at Westminster Bridge are some of Mr. Wigham's. They are giving great satisfaction, but will be continued for only a limited period, as it is now proved that if the public like to pay for it, we can give them a better light than the electric light ever will, and at a very much reduced price. We lighted Waterloo Place as far as Regent's Circus; but for some reason or other we were directed by the Vestry of St. James to remove the new lamps and to reinstate the original lamps which are now in use all over the Metropolis. I do not know the reason why they directed us to remove them, but we had no other course to pursue than to obey their orders; consequently the improved lighting has ceased in that neighborhood.

The Secretary has read the proceedings of a special meeting, authorizing us to proceed with a bill for various purposes. The great object of that bill was to enable us to do as they do in Paris and in other parts of the Continent—that, is, apply our capital to providing, either for sale or for letting on hire, cooking apparatus and different articles for the other uses of gas. The Board and the Committee were quite unanimous in approving that bill. It so happened that a bill for the same object was laid before a Committee of the House of Commons from a provincial company, and they so completely stamped out the whole principle of such a procedure, and so entirely disapproved of it, that as we were going before the same committee at a subsequent period, we thought it best to withdraw our bill before going to the expense of contesting it in the House of Commons; therefore, the bill was withdrawn. It has caused a very small expense to the company, and we are just as we were when I last addressed you. We were compelled by our Act of Parliament to adopt our auction clauses in our last raising of capital for the company to the amount of £100,000. That auction took place some short time ago, and I am free to confess that I think we made some little mistakes in the mode of procedure which we should not do on another occasion. We put the lots in too large amounts for many parties, and, consequently, the whole was not disposed of, and by our Act of Parliament we were instructed to offer that balance to the Proprietors at the reserved price which we put upon it at the auction—namely, 175; and I am happy to say that if we had no auction whatever we could have raised the whole of it from our Proprietors at that rate. So great is the confidence of our constituency, that they would have taken the whole, and double the amount if we had been able to offer it. Even since the report has been sent out, accompanied by the notices that we were to raise money by debenture stock, large amounts have been applied for of the A stock by those who wish to increase their investments. I think that is a very satisfactory feature in the affairs of the company. We shall have to raise more money by-and-by, for there are very large loans coming in to be paid off, and we take power to-day to raise the amounts by debentures. We are going to do this within a very short time, and I may say that very likely we shall require to have another raising of capital by auction or tender within the present year. We shall take into our most deliberate consideration the mode we should adopt in raising that money, and I hope we have gained a good deal of knowledge and experience as to how the stock should be raised. We are going to declare, gentlemen, the same dividend as we did in the last half year—namely, at the rate of 10½ per cent. The stock which was lately sold at auction will not participate in that dividend, but will participate in the accruing dividend during the current half year—that is the dividend which I hope we shall declare in February next. This was all explained at the time of the auction and we heard no dissatisfaction expressed. Every one was made aware of the intention of the company in that respect. Just before the close of the last meeting, I think that I alluded to the question of amalgamation. We were very confident at the moment that there would have been a large amalgamation carried out. We left this room with that impression; but I regret to say, speaking for myself and speaking for others, that that scheme completely fell through. I need not enter into particulars of it at present. It was the action of one of the companies with whom we proposed to be amalgamated. The fact is that they thought that they would do better—and of course they were justified in trying to do better—in the interests of their Proprietors. The only other matter I will allude to is to express the deep regret of the Court of this Company at the loss we have sustained during the past year in the death of our Chief Inspector, Mr. Johnson. He died very suddenly four months ago. I have known him as an Inspector ever since I have been connected with the Company. He was associated with the Company longer than I have been, having served it for the last thirty years. The question was mooted as to what the Directors proposed to do in consideration of his very long services, and they have determined to make a small grant to his widow from the funds of the Company, paying up his salary to a certain period; and I think the matter had better be left there. The Court have nothing further to propose; in fact, they postpone any further consideration of it for a short time; and, in the meanwhile, a very solid subscription has been raised amongst the officers and employees of the Company, which has realized a good sum for the widow. Gentlemen, in conclusion, I have merely to say that these accounts bear somewhat of a historical character. For the first time in the existence of the Chartered Gas Company we have reached one million pounds as our receipts upon revenue for gas-rental, for the half year under consideration. I think this is a feature that we may bear in mind in future, and I am only thankful that I have been able to announce it to you. I now beg to move—"That this meeting do agree with and confirm the report of the Directors, and the Auditor's report and statement of the accounts of the Company, as transmitted."

The Deputy-Governor (Mr. E. Vaughan Richards, Q. C.) seconded the motion.

Mr. Samuel Jackson said that when the working of the last half year had been so satisfactory, the Proprietors took little interest in the proceedings. As to the policy of the Board in regard to the reserve-fund, he thought that in times of prosperity, although a large dividend could be declared, prudence was equally necessary and advisable. He was aware that coal was exceptionally cheap, but he did not think, because the raw material was so cheap, and that they had possession of it for a considerable period, that something ought not to be done towards building up the reserve-fund. The net income on the ordinary capital was something like £400,000, while the reserve-fund amounted to £100,000. Ten per cent. was a handsome dividend, and it was enough to excite jealousy among outside parties. Ten and a-half per cent. was still more satisfactory; but he thought there should be an addition made to the reserve-fund.

The Secretary explained that no addition could be made to the reserve-fund until the end of the year.

Mr. Jackson hoped that in the last half of the present year the question would have the attention of the Board, and he trusted to see a large addition to the fund; it was only reasonable. There had been one coal famine, and it was only right that preparation should be made for any eventuality that was certain to arise in the course of time.

Mr. Graham asked, in reference to the contract for coals, whether the contractors were liable for any of the loss arising, during the recent strike, from the purchase of inferior coal.

Mr. Baddeley said that as shareholders they ought not only to congratulate the Court, but also the Engineers and Managers, who had the manipulation of the affairs, that there had been no fines inflicted on them during the past half year. When they knew how thoroughly they were watched by the great authorities they came in contact with, he thought that the fact he had mentioned redounded to the praise of those who had the manipulation of their works. With regard to electricity, he had said at a former meeting elsewhere that he always considered there was a field for it; but he also said that the history of gas companies had not been written, and it was especially so with regard to their own company; because when he compared the figures of the gas-rental this half year with those of last half year, it was satis-

factory to know there had been an increase of £100,000. That was an increase unexampled in the history of any gas company. The profits from residual products also were large. In looking at the statement of residual products, he thought that they had held their own with regard to the sale of coke; but as the increase of gas was so large in comparison with the previous year, the make of coke had also been necessarily large, and they had not been able to command the same price. This, doubtless, arose from the fact that there was a very large amount to dispose of, and there was the element of cheap coal to come in competition with it. Looking at the two items they had no cause to regret that they had increased their rental on the one hand, and that a loss had been sustained in the sale of the residuals on the other. The accounts presented were so favorable that there could not be one dissentient voice in the meeting as to the success of the Campany, and he wished to congratulate the Directors on the way in which they had managed the affairs of the Company during the past half-year.

Mr. Burls asked, with regard to the Bill that had been withdrawn, whether the cause of the withdrawal had reference to the proposal of the Company to undertake the inspection of gas-fittings, or to the projected supply of machinery for the consumption of gas. With regard to gas-fittings, it was his earnest hope that they would obtain power to do as they did on the Continent—namely, dispense with gas-fitters. He thought that the bad supply of gas in houses arose very largely from bad fittings. All the Company had to do was what was done on the Continent—namely, if there was any fault to be found with the gas supply, they should have an opportunity of going into the houses and seeing where the fault lay.

Mr. George Livesey said that he believed the reason why coke was not used for domestic purposes was because, as made, it was not fitted for such purposes. It was too large to burn properly. On the Continent coke was broken by the gas companies, and in that form it found a ready sale for domestic use. The difficulty in selling broken coke here arose from its bulk being materially reduced by the breaking; that which filled 12 sacks in an unbroken state would fill only 9 sacks in a broken state. He, therefore, thought that before any considerable trade could be effected in broken coke, the companies would have to give up the system of selling by measure, and sell by weight. He was glad to hear the remarks made by the Governor about the late Mr. Johnson, and that the Directors had taken up the matter, thereby rendering it unnecessary for him to make a proposal to the meeting. He was quite satisfied to leave the matter in the hands of the Directors.

Mr. A. Gurney said that no doubt an increased dividend was an acceptable thing, but the reserve-fund was of much greater importance. Before they divivided ten a-half per cent., he thought the reserve-fund should be increased.

Mr. H. J. Slack said, in reference to the reserve-fund, he did not see any reason for departing from the resolution of the Directors. He felt perfectly confident that it would not do any harm if the business of the Company was as efficiently managed in the future as in the past. He did not think it was a misfortune to the Company that they had not power to buy and sell different kinds of implements for the consumption of gas. It appeared to him that there would be this evil attending it—the Directors would have to choose between certain forms of apparatus. His opinion was that it would be the interest of the Company to give every possible encouragement to inventors to bring forward new modes of utilizing gas for various purposes. It was impossible to go into any of the London shops without seeing that gas was very badly used. It was not the badness of the gas, but the unfortunate implements of the gas buyer, who took an article and did not know what to do with it. He did not say that it was impossible to make bad gas; but good gas was often put to bad uses. People did not take reasonably scientific pains to secure ventilation. He asked if it might not be in the function of the Company to get up a sort of exhibition, at which the makers of all really good burners could exhibit them, and also the modes of cookery and so forth. Then he thought the inspectors of meters should have a little scientific information in order to get rid of difficulties which were almost insurmountable. He believed that in London the use of gas would be doubled—nay, trebled in a short time if the public were not so ignorant of the elements of physical science. He did not wish to propose any resolution, but he thought that some mode should be adopted of popularizing information on gas matters, in order to prevent the mistakes which were now almost universally made.

Mr. W. H. Bennett said that Mr. Livesey had expressed an opinion that if coke were broken small, in order to fit it for domestic consumption, it would necessitate the sale of the article by weight instead of by measure, since it was found that when coke was reduced in size, a chaldron would contain much more than when the coke was unbroken. He was, however, at issue with Mr. Livesey upon the necessity for sale by weight, because he knew that in Paris, and other continental places, where the coke was broken and passed through sieves of various meshes, to suit for different consumers, a price was paid proportionate to the size to which the coke was reduced. The system had been found to work remarkably well, both as regards the inducement to purchasers and increased profits to the suppliers. He hoped that the Company would see their way to follow the example with a view to increase its domestic use, and, if so, he trusted that the plan would be followed with equally satisfactory results. He intended to have prepared some further remarks upon the question, but the accounts had come into his hands so late as to preclude his doing so.

Captain Giffard (a Director) said that during the last winter he was seriously ill, and had in his room a gas fire, which never went out, and a better an more comfortable fire there could not be.

The Chairman, replying to the various speakers, said that in regard to the coal contracts, the question had been asked whether the contractors were liable for any of the loss to which the Company had to submit in the purchase of inferior articles; but in all contracts now-a-days there was a direct clause which protected contractors in that respect. They were not liable for any expenses which might be incurred through a strike at their works. One of the great causes of the diminished receipts for coke was, in the first instance attributable to the extremely wet weather they had had during the last winter, spring, and, he might say, summer, which had thrown the building trade completely out of gear; and, consequently, cement makers had not been taking the usual quantities. A large quantity which they could not dispose of was thrown upon the hands of the company, who were obliged to take the best price they could for it. Their coke agent was at present on the Continent endeavoring to establish continental connections, whereby it was hoped, and it was pretty certain that they should be able to dispose of a good deal of their coke. As regarded the bill in Parliament, the Committee gave no special reasons for their rejection of the measure; but the Directors thought that, as their bill was going before the same Committee, it would be madness for them to proceed with it. In regard to the reserve-fund, a very large balance of undivided profits was carried over, and it was in the power of the Board to apportion any part of that to the reserve-fund at the proper time. Shortly after their amalgamation with the Imperial Company, which had resulted so favorably, the Board determined to accumulate a large reserve-fund, and they had not changed their opinion as to that. They had a very good reserve-fund now, and, by means of annual additions to it, it would amount by-and-by to a large sum of money. In regard to making public the different uses to which gas could be applied in the way of heating, cooking, and lighting, the Company had subscribed largely to the recent Exhibition at Kilburn, for the express purpose of exemplifying the different modes in which gas could be used, and though a great number of the gentlemen before him were not present, on account of the very bad state of the weather, the Exhibition of those articles was a success; and many people who were there were greatly pleased with the different modes of employing gas, both for cooking and heating purposes. He thought he had now answered all the questions that had been put to him.

The Deputy-Governor said as he was engaged both in the Brighton and the Crystal Palace bills, he could tell them in a few words what occurred. The Brighton Company proposed to supply cooking apparatus, but they were opposed by the Corporation of Brighton, on the ground that it was an undue competition with the trade in Brighton. The Committee unquestionably adopted that idea, and so the Directors of the Chartered Company thought it would be a mere waste of money to bring a bill before the same Committee which had just rejected the bill of the Brighton Company. Shortly afterwards the Crystal Palace bill came on, and he happened to occupy the opposite position to that in which he was placed with regard to the Brighton Company. He was opposing the bill on behalf of certain traders. The bill went through the House of Commons without opposition, because the traders were not in time with their petition; but before the House of Lords a large number of persons interested in gas-fittings in London presented a petition, but their lordships came to exactly the opposite conclusion to that to which the House of Commons had come with regard to the Brighton bill.

The motion for the adoption of the report was then put and carried unanimously, as was also one for the declaration of the usual dividends, and the usual compliment to the Chairman brought the proceedings to a close.

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New Preparation of Carbolic Acid.—Messrs. F. C. Calvert and Company have introduced for domestic disinfecting purposes, solidified disinfecting tablets containing fifty per cent. of concentrated carbolic acid. The great advantage of this solid form is that it removes the danger of accidental poisoning, and from the high percentage of acid present, the tablets provide, even when dissolved in a considerable quantity of water, a solution capable of arresting all kinds of putrefactive change, and of destroying all the lower forms of insect, vegetable, or germ life.

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Cure for Burns.—An iron-foundry man recommends powdered pine-wood charcoal as "a never-failing, speedy remedy" for burns and scalds.

[From the "Journal des Usines a Gaz.]

## Experiments in Lighting at Havre Harbor.

In November, 1878, the Engineers of Bridges and Roads gave me notice that trials by the Jablochkoff system of lighting were to commence during the following month in a part of the port of Havre, in accordance with instructions from high authority who had voted a credit for this purpose. M. Quinette de Rochemond, Engineer of the Bridges and Roads, asked the European Company to make comparative trials in order to see whether it was possible, by means of gas, to light the port of Havre in a more complete manner, than at present, so as to make the harbor easy of access when the tides were favorable.

In order to equal the intensity of the electric light it was found necessary to construct a burner capable of consuming a large quantity of gas—like that of Mr. Sugg, an English engineer of great merit. This burner was examined by the Administration of Bridges and Roads, and by myself, and it was discovered that, in consequence of the changes of temperature and high winds which are of frequent occurrence at Havre, it would be necessary to employ a glass chimney. This, it was thought, would make the burner too costly, and further, it was found that its intensity was not great enough to be employed with advantage. Consequently an effort was made to obtain a flame capable of giving a light equal to 18 or 20 carcels; but the difficulty was to arrive at this result without employing a glass chimney. After researches which kept me occupied until the middle of December, I applied myself to the perfecting of a flame which I had invented, as well as to the type of a new lantern. After repeated efforts at the gas works, and when the experiments appeared to give satisfaction, we learned that the Parisian gas company had decided to enter into the contest with electricity, and that several engineers at Paris were endeavoring to discover a light of great intensity.

It seemed to me useless to continue the researches commenced at Havre if at Paris burners of great power could be found to consume gas in the open air. At that time M. Giroud was constructing a burner to consume a sufficiently large quanty of gas. M. Lepante, so well known for his remarkable horological works and the improvements which he had introduced in the lighting of lighthouses, had his attention also directed to this point, and was engaged in perfecting a burner having three circles, which was first brought out in the year 1869, and with which he expressed himself willing to conduct experiments at Havre during the month of January. The burner was provided with a glass.

In the same month I recieved from M. Maldant a burner to consume gas in the open air, but the consumption was too weak to attain the object in view. During a visit made to Mr. Bengel, manufacturer of gas apparatus in Paris, he presented to me a burner provided with a joint which enables two flames from opposite sides to meet, and the lighting power from which was superior to that obtained by the use of ordinary burners. The cause of this increase of light is attributable to the augmentation of the temperature which makes the combustion of the gas more complete. From the beginning our experiments were with split burners, placed either on the same line or in such a way that the flames converged upon a common centre. A stand of twelve burners was placed in the court at the gas works in a lantern of proportionate dimensions. The effect was satisfactory enough, but the arrangemsnt had the inconvenience of allowing certain spaces between, and the blue parts to be seen at the bottoms of the flames; and, further, on the application of the photometer the light did not offer advantages sufficient to permit of its application to the lighting of the port.

These varied trials not having given the wished-for results, I again set myself to the work, in the hope of overcoming the difficulties which I had encountered in the employment of a burner without a glass chimney, and with a consumption of more than one cubic metre. I will not here try to describe all our experiments, as that would lead me into too much detail. I will only say that my researches have been limited to ascertaining the best conditions for combustion, and at the lowest pressure at the burner; (2) to maintain for the longest possible period flames in contact with the air; (3) to study the most convenient diameter for the holes of the burners; (4) to discover the proper space that ought to separate the burners; (5) to raise the temperature by the reunion of the flames at their extremity so as to prevent particles to escape unconsumed; and (6) to contrive what was the proper quantity of air necessary for thorough combustion.

These different points have been successfully treated, and our object has been attained by means of a burner composed of horizontal jets, of which the following is a description:

In the arrangement adopted the gas reaches a reservoir and is distributed to the circle of jets by means of four channels. The second circle, smaller and higher than the first, is supplied by one single pipe running directly from the reservoir. This pipe is divided into two parts before its junction with the second circle. Taps are fixed on the supply pipe to the second circle in such a manner as to regulate the size of the flame, after the fashion of a metal chimney with or without an interior cone. This chimney is placed at a certain distance above the flame. All the jets, to the number of 80 for light of 1,600 litres, are pierced laterally, and on the outside of the circle, and a pressure of 13 to 14 millimter is maintained in the upper pipe, and suffices perfectly for the supply of the burners.

Under these conditions, and with such a combination, it has been found that the consumption is most advantageously effected when burning from 15 to 16 litres per hour. Above these figure the results are not so good. There is therefore a limit to the consumption which must not be exceeded. On the same principle burners may be made to consume hourly 800 litres. It has been my effort to give an exact statement of the advantages burning in the midst of a high temperature may present, and having this in view I will now proceed to state my experience.

The external temperature was 5 degrees. In a room which was maintained as free from draughts as possible, the photometer was placed with a Lowe jet, the height of the flame of which corresponded to a consumption of 105 litres. In order to obtain a higher temperature a stove was lighted, and a jet of gas having an ordinary chimney. In proportion to the elevation of the temperature ascertained by means of a mercurial thermometer, it was found necessary to diminish the height of the flame in the gas shade, and that of the Lowe jet. The consumption of this last-named jet was not more than 105 litres at the conclusion of the experiments; but only 70 litres were necessary to attain the lighting power of the carcel lamp. The air having been brought back rapidly to the external temperature, one could then perfectly see the flame of the photometer and that of the burner in the glass chimney considerably diminish.

The result of these experiments has been the adoption of lanterns as close as possible. Variously shaped lanterns have been made for this burner—round, square, and horizontal. In the one adopted the framework permits of the expansion of the glass, and enables the glass to be easily removed, cleaned, and replaced. The top of the lantern is made in such a way that a current of heated air issuing from the metal chimney produces to some extent a vacuum in the interior of the lantern, and eliminates part of the heated air there concentrated, and thus establishes a current between the burner and the glass. The metallic chimney is surmounted by a perforated cover, in which the interior cone serves to lessen the effect of the winds which break upon the cover. The slight current of air necessary to feed the burner is admitted at the foot of the lantern, and its action is such that the flame, so far from being affected, remains almost steady. Keeping a small burner lighted the entire day in order to light the larger burner at night is a somewhat inconvenient arrangement. I prefer to make use of a tube lighter, pure and simple. In the lamp-post there is a door giving access to two taps, arranged, one on a tube of 16 millimeter of internal diameter, which serves for the supply of the burner, and the other on a smaller tube standing at a little distance from the large burner, and in which the holes are pretty closely pierced. When the tap is opened and the first jet in the lighting tube fired, the flame quickly communicates itself to the lantern, and then one has only to open the principal tap and the burner is fully lighted. The action of the lighting tube is then stopped, as it is no longer necessary. All the photometric experiments were made by means of the Delnel apparatus. At the side of the burner a division separates the piece in two parts, in order to prevent the rays of the lamp interfering with each other. A carcel lamp of the M. Giroud description was also made use of. * * Since 20th March last the north pier at Havre has been lighted with an intensely strong light. The experiments which I made naturally led me to seek for a proper light to illuminate factories, art galleries, foundries, etc., and I have now introduced an apparatus for burning from 800 to 1,600 litres an hour. These burners are destined to render great service in the industrial services, their moderate price and the fact that they can be applied without disturbing present arrangements will facilitate their development. The object of the European Company will be attained if my colleagues can draw conclusions from these facts fitted to effectively combat with electricity, which seeks by all possible means to swallow up our industry. GAUTIER.

## New Discovery in Connection with Carbolic Acid.

BY JOHN DAY, M.D.

Several important additions have recently been made to our knowledge of the chemistry of carbolic acid, some of which are possessed of great interest to us as medical practicioners. For instance, Stäedler has shown that it is a constant constituent of the urine; Brieger has shown that it is a normal constituent of the contents of the bowels; and Baumann has discovered that it is one of the products of the putrefaction of albumen. For an interesting account of these and other discoveries in connection with carbolic acid, I would beg to refer you to an editorial article in the *Medical Times and Gazette*, of October 12, 1878, entitled the "Pathological Excretion of Carbolic Acid." I have myself devoted a good deal of attention to the chemistry of carbolic acid, and in the course of my investigations have found that

it is a powerful deoxidizing agent—a property which has not, that I am aware of, been previously recognized.

I will show you a few experiments by way of proving that my view on this point is correct. Guaiacum resin, when oxidized, is changed from its normal color, which is reddish brown, to a deep blue, and this effect can be produced by a number of oxidizing substances. I have chosen, as sufficient for my purpose, solution of permanganate of potash, black oxide of maganese, tincture of iodine, and the vapor of a solution of chlorine. I will now oxidize some guaiacum resin with the different substances I have named, and then deoxidize it and restore it to its normal color by the addition of carbolic acid. That this is simply a process of deoxidation may be shown by the ease with which the guaiacum can be again oxidized. I can offer you another proof of the deoxidizing power of carbolic acid by adding a drop or two to a solution of permanganate of potash, when you will find that it will be instantly reduced and decolorized.

I will show you one more experiment in proof of the deoxidising properties of carbolic acid, and it is one which I think will interest you, as it is a little suggestive of the action of carbolic acid on the iron in the blood, when it is administered internally. This bottle contains a weak solution of persulphate of iron, and to show you that it does not contain a trace of the protosulphate I will add a few drops of a solution of red prussiate of potash, a salt which has no action on persulphate of iron, but quickly turns the protosulphate blue. By the use of this test we have not, as you may perceive, produced any change of color in the solution; but on the addition of a little carbolic acid you will find that a deep blue reaction will occur, thus showing that the persalt of iron has been reduced to a protosalt.

If you will permit me to trespass on your time for a few minutes longer, I will show you a very curious reaction which carbolic acid is capable of effecting, and it is one which has not yet, I think, been mentioned in any work on chemistry. When carbolic acid is added to tincture of iodine no perceptible change takes place, but when carbolic acid is added to tincture of iodine freely diluted with water, the fluid is almost instantly decolorized, and a compound is formed which is incapable of acting on starch and turning it blue, as free iodine does. Now, it has struck me that this combination of carbolic acid and iodine might form a good antiseptic dressing for wounds. Indeed, the main object of my paper has been to excite a discussion on a theory I wish to place before you regarding the action of carbolic acid as an antiseptic.

The investigations of Pasteur, Tyndall, Sanderson, Lister, and others, have clearly shown that putrefaction changes never take place without the presence of bacteria; and, further, that the bacteria are dependent on oxygen for their existence. Now, it has occurred to me that the deoxidizing properties of carbolic acid offer a fair explanation of its modus operandi in the antiseptic treatment of wounds.

During the reading of this paper Dr. Day demonstrated by several experiments the correctness of his conclusions.—*Australian Medical Journal.*

## Steam Heating as Applied in Cities.

The Spinola plan of heating the building of a whole city or town by steam is severely attacked by "An Engineer" in a letter published in one of our dailies. He considers it an enormous stock jobbing scheme, alongside of which any possible elevated railroad grab sinks into utter insignificance and appears an innocent operation. His calculation is as follows:

"There are in this city, exclusive of Morrisania and West Farms, fully 1,600 built-up blocks, with about 90,000 houses, making 16 steam districts, and requiring 16 times 240,000,000 cubic feet of steam per day as the estimated supply. Not quite two-thirds of this steam will be virtually furnished to customers, as fully one-third is lost by condensation and leakage. But to afford a daily supply as averred, would necessitate the making of about 4,000,000,000 feet of steam every 24 hours, or nearly as much as the supply of illuminating gas now amounts to in a whole year. About 8,000,000 gallons of water would be required per day to be distributed among 1,000 boilers, each of a capacity for evaporating 18,000 gallons of water in 24 hours. The daily water supply would have to be increased one-fifth its present capacity, and in order not to place the city on 1,000 small volcanoes, by running that number of boilers all the time (24 hours), the boiler service must be doubled—that is, 2,000 be set up, each one running 12 hours per day. It is unnecessary to say more in pointing out the monstrosity of the scheme, even admitting that former figures, on which the foregoing calculation is based, were exaggerated. But who will dare to say that cheap heat can be supplied by this steam scheme, and what on the whole the boon offered by this corporation will amount to? Can one bake, broil, roast, melt or smelt with the heat thus furnished? If the steam is furnished superheated, its cost will be enormous, and if supplied as ordinary steam it will afford 212° Fah., and no more. But it will never be furnished on an extensive scale, for the bubble will have to burst long before the last of the confiding fools who put their money in it has been reached by the operators."

The above statement may have something startling in mentioning the 4,000,000,000 cubic feet of steam necessary per day, and comparing it with the gas furnished to a city of this size; but after a thoughtful consideration it soon dwindles down, and appears no more startling than the results of any gas works, about which, before its general introduction, similar objections were used.

In the first place, the water used will by no means be lost, because most all of the steam employed will be retured to the boilers, as is the case with all steam heating contrivances; it is simply a circulation of the water, which serves to convey the heat to the various buildings, which heat is given off during its condensation, while the hot water into which it is converted returns to the boilers, which, for that purpose, are always placed at the lowest practicable level. Therefore the objection that it would necessitate an increased water supply falls to the ground.

Let us now look at the cost of the fuel required. As every pound of coal consumed can convert 14 pounds of water into steam, 8,000,000 gallons, or 64,000,000 pounds of water necessary would require 4,500,000 pounds of coal, which for 90,000 houses is 50 pounds each per day, so that a ton of coal would furnish steam for 40 days, and 3 tons be sufficient for 120 days, or 4 months. We would like to know if there are many houses where 3 tons of coal are sufficient to do the heating and cooking during the four winter months.

The pretentions that the cost of superheated steam is enormous, and that ordinary steam will only afford 212° Fah., and no more, are equally false. Ordinary steam, as used for heating purposes, at a pressure of 60 pounds, has a temperature of some 280° or 300°, and this is sufficient for family use. The Spinola plan does not pretend to furnish heat for melting and smelting operations. The demand for such heat is very rare in cities, and can be easily supplied by gas or other fuel, also in cases where broiling and roasting are required.

If we test the amounts mentioned in the above calculations with our experience, they will agree, and do not appear exaggerated. In the five story and basement building in which the *Manufacturer and Builder* is published, 180 tons of coal are used on an average per winter. The building occupies a whole block, and being rented out to about 60 different concerns, among which is the New York *World*, is equivalent to 30 ordinary houses; so that the 180 tons of coal is 6 tons for each house per year. The steam heating is applied for about 7 months.

The following paragraph is identical with the objection made fifty years ago against the introduction of gas:

"The laying of pipes alone will kill the scheme, as it will prove wholly impracticable. But by all means let a test be made in one district to prove the utter impracticability of Spinola's bantling.

We answer, if steam is found economical for heating our public buildings, like the Cooper Institute, our large libraries, also almost every building in which large publishing concerns are located, in the principal hotels, the new buildings erected by insurance companies, those by various other companies, and by private capitalists who have recently invested in colossal sites, why then would the system cease to be economical when applied to a whole block? And if economical for a block, why not for a district?

But the true inwardness of the criticism of "An Engineer" crops out in his closing paragraph. He says:

"What we need is cheap, clean, and convenient fuel for all purposes, in the shape of gas—fixed, unchangeable, and non-explosive, and capable of producing any degree of heat from the boilng of water to the smelting of iron."

This shows that the whole article is an attack in favor of gas companies. —*Manufacturer and Builder.*

Lighting of Waterloo Road.—The Lambeth Vestry have entered into an arrangement with the Phœnix Gas Co. for the retention of the large lamps, giving a more brilliant and much improved light, which the company erected some months ago in Waterloo Road for experimental purposes. At the last meeting of the Vestry the Lighting Committee recommended that the lamps in question be retained to the following extent: Lamps at 40 yards apart, and on alternate sides of the way, from Waterloo Bridge to the junction of Stamford Street and York Road; and from that point to the railway station that the lamps be retained at the corners of Ann Street, Agnes Street, Frances Street, and Cross Street; also three others on the east side, between Church Street and Stamford Street; also, two under the railway bridge. The committee considered that these, with the two triple Argand lamps, would be sufficient to secure a much better lighting of the road than before the Phœnix Company made their experiments. It was stated that the proposed improved lighting of the road would come to about £60 a year more. Some opposition was manifested to the recommendation, but it was adopted.—London *Builder.*

## Correspondence

### The Use of Water to Prevent Stoppage of Ascension Pipes.

To the Editor of the American Gas Light Journal—

Dear Sir: At the quarterly meeting of the Central New York Gas Engineers Association, a report of which appeared in your last issue, I see that the introduction of water into the stand pipes, for preventing stoppages, and for cleaning them when stopped, is spoken of as "a new idea advanced." In 1851, while I was superintendent of the Richmond, Va., gas works, I was troubled with stoppages in ascension pipes, as, at that time, I was using Midlothian coal; and, as a means of clearing them, I employed iron pots, such as may be found in any hardware store, which I filled with water and placed inside the mouth pieces. The steam generated worked its way between the tarry substances and the walls of the stand pipes, and, in some cases, the caked tar came out in long rolls the size of the pipe.

For a slight stoppage I made use of small pieces of ice, by removing the plugs from the top of the stand pipes, and introducing a piece into each then replacing the plugs—it proved an efficient remedy.

In 1871 I invented a retort-lid, with a receptacle for water on the inside, holding about two gallons, with an aperture one and one-half by five and one-half inches, to allow the steam to pass through into the retort and then up the stand pipe. After giving these lids a practical test, I found that they completely obviated that disagreeable annoyance to gas engineers—stoppage in stand pipes. The above may be of use to the gentlemen discussing the question.

Yours, respectfully,
Edward Jones,
Supt. South Boston Gas Works.

## Petroleum Production and Prices.

To "strike ile" was not long ago considered in the United States to be synonymous with being well on the road to making a fortune, and the phrase was generally used as a neat and epigrammatic method of conveying an intimation to that effect. Nowadays, however, the phrase lacks its old significance, if it does not in many cases mean exactly the reverse of the interpretation which was formerly put upon it.

The letter of our well-informed Correspondent at Pittsburgh, published in our last issue, is replete with forebodings of disaster and danger to the petroleum producers, and reveals the existence, on an almost univeral scale, of a state of things which has come about so rapidly as to be almost beyond belief. We learn that all attempts at effecting an organised reduction of the output have hitherto proved unmitigated failures, and that the producers are going ahead at such a rate that the stock is almost immeasurably in advance of the wants of the market. That fact, nevertheless, does not appear to discourage the well-owners and derrick-workers, who continue to pump the oil at as great a rate as though not a single barrel was in stock. Their strenuous, even if misguided, efforts have at last brought about a catastrophe and a check. The means of storage have been exhausted, all the tanks being filled to absolute repletion, and the pipe lines having more than they can carry. Still, however, the producers go on, and such is the intensity of their folly and their devotion to the mineral oil which lies beneath their feet, that they are stated to be wasting as many as from 7,000 to 10,000 barrels daily, or from 40,000 to 70,000 barrels every week. Whether the infatuation of the well-workers possesses any method in its madness or not we are not at present informed, but it is added that at some points the oil is run into the creeks and ravines, and is there dammed-up and burned in order to prevent serious conflagrations in the towns through which it would otherwise flow. The pecuniary loss ultimately involved in this mode of procedure, which our Correspondent aptly terms "oil-crazed idiotcy," cannot at present be estimated, but the day of reckoning will surely come, no matter how long delayed. No individual, and no nation, is so rich as to be able to utterly waste his, or its, wealth in such a flagrant manner. The oil-wells of the United States at present seem inexhaustible and capable of almost illimitable extension, yet there is always the possibility that they may give out, and that the valuable material which is now being so desperately destroyed may become of great relative value. Even under ordinary conditions the oil may speedily rise in price, bearing in mind the enormous increase in the demand which is taking place all over the world, the extended application of coal for heating and lighting purposes, and the circumstance that the United States practically monopolizes the production. On every economic ground, therefore, such a wilful waste is to be deplored, even although that waste may not at present bring about its sequent woful want. From the present and purely commercial point of view, dealers and consumers in all parts of the world may, perhaps, congratulate themselves upon the complete freedom from anxiety as to the course of prices, which results from such a remarkable plenitude in the supply; but even this view has its drawbacks, inasmuch as the enormous production will inevitably ruin many, and cause others to be ultra-cautious, which causes, combined, may tend to force on a successful combination to restrict the production. Under great financial pressure the well-owners may possibly do what they have hitherto failed to effect, and may from sheer desperation set their united house in order. A craze, especially in mining matters, will often have a long run, but its end must come sooner or later, and with it such an amount of burning of fingers as will certainly tend to make those once burned dread fire in future.—*The Ironmonger.*

## Lime and Hydraulic Cement.

From various authorities, among which may be named, Vicat, Burns, Haswell, and General Gilmore, the following statement of the various characteristics of the different kinds and qualities of lime and cement has been compiled:

1. The rich limes are the purest metallic oxide of calcium we possess, and the purer the carbonate of lime from which they are obtained, the more distinctly marked are the appearances from which they derive their name. These are they that augment in volume to twice their original bulk, or even more, when slaked in the usual manner, and that they will not set (harden) under water if not mixed with any other mineral material, even though left immersed for years.

2. The poor limes are those which do not augment in bulk at all, or only to a trifling degree, when slaked. They do not set under water any more than the rich limes.

3. The moderately hydraulic limes set under water in from fifteen to twenty days, but do not become very hard. The change of bulk they undergo in slaking is the same as that of the poor limes, but never equal to that of the richer varieties.

4. The hydraulic limes set in from six to eight days' immersion, and continue to harden for some months.

The eminently hydraulic limes set within three or four days, and become quite hard in a month.

A classification of rocks with reference to chemical examination is as follows:

1. Pure calcareous rocks, or those containing from one to six per cent. of silex, alumina (common clay), magnesia, iron, etc., either separately or in combination, give rich limes upon being calcined.

2. The limestones containing silica in combination with alumina, magnesia, the oxides of iron and of manganese, in various respective quantities, but limited to between 15 and 30 per cent. of the whole mass yield poor limes.

3. The limestone containing silica in combination with alumina, magnesia and traces of the oxides of iron and manganese, in various respective proportions, but within the limits of from 8 to 10 per cent. of the whole mass yield moderately hydraulic limes.

4. When the above ingredients are present in the proportions of from 15 to 18 per cent., but the silica in its soluble form always predominating, the limestones yield a hydraulic lime.

5. When the limestones contain more than 20, and up to 30 per cent. of the above ingredients, but with the soluble silica in the proportion of at least one-half of them, the limestones yield eminently hydraulic lime.

The experiments upon which the above conclusions are based appear to show that limes owe their hydraulicity, or power of setting under water, to the presence of a certain quantity of clay, and sometimes, but rarely, to the presence of a certain quantity of pure, soluble, silica; and upon that principle a large proportion of our hydraulic cement, or water lime, is manufactured by mixing common fresh burnt lime with burnt clay and grinding them together, generally in the proportions of 20 parts of clay to 30 parts of very rich lime, but the proportions vary with the qualities of limestones and clays found in different localities.—*Iron Age.*

The Cost of Colliery Accidents.—The following facts, elicited at the last annual meeting of the Lancashire and Cheshire Miners' Permanent Relief Society, held at Wigan, will give some idea of the terrible results of the accidents occurring in a single district of the British coal fields, and of the scale upon which monetary relief is distributed among the various causes of sufferers by such disasters. It was stated at the meeting referred to, that the society now numbers 27,281 members, and the income for the year 1878 was $93,755, of which the men contributed $81,612, and the colliery proprietors and honorary members $5,948. The expenditure during the year was $91,043, the principal items being: Funeral payments on deaths of members, $3988; to widows of members, $4825; children, $11,480; on account of disablement of members, $37,210; and for medical attendance, $19,708. During 1878 there were 5245 cases of disablement, 1850 of which only received one week's pay; and 72 fatal accidents, causing the death of 80 members, and placing on the funds 42 widows and 83 children. At the close of the year 162 widows and 377 children were receiving annuities from the the society.—*Ibid.*

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THURSDAY, OCTOBER 2, 1879.

## Official Report of Examinations of Gas for two Weeks ending Sept. 27, 1879, made at the Photometrical Room of the Department of Public Works.

### Corrected Illuminating Power.

| Sept. 1879. | Time of Day at which Test were made. | New York Gas Light Co. | Manhattan Gas-Light Co. | Mutual Gas-Light Co. | Metropolitan Gas-Light Co. | Harlem Gas-Light Co. | Municipal Gas-Light Co. |
|---|---|---|---|---|---|---|---|
| 15 | Between 9.30 A.M. and 1 P. M. | 16.47 | 16.91 | 19.12 | 17.10 | 16.50 | |
| 16 | | 16.51 | 17.56 | 19.80 | 17.05 | 16.47 | |
| 17 | | 16.20 | 17.66 | 20.38 | 16.93 | 16.55 | |
| 18 | | 16.72 | 17.06 | 19.37 | 17.67 | 16.64 | |
| 19 | | 16.54 | 17.00 | 19.80 | 18.19 | 16.85 | |
| 20 | | 16.73 | 16.93 | 18.92 | 17.32 | 16.13 | |
| | Average | 16.53 | 17.18 | 19.56 | 17.37 | 16.52 | |
| 22 | | 16.68 | 16.96 | 18.65 | 17.64 | 16.47 | |
| 23 | | 16.58 | 16.62 | 18.42 | 17.57 | 16.46 | |
| 24 | | 16.31 | 16.51 | 17.82 | 17.43 | 16.13 | |
| 25 | | 16.62 | 17.28 | 18.87 | 18.29 | 16.47 | |
| 26 | | 16.58 | 17.02 | 20.02 | 18.05 | 16.62 | |
| 27 | | 16.57 | 17.00 | 20.72 | 17.45 | 16.41 | |
| | Average | 16.55 | 16.90 | 19.08 | 17.74 | 16.42 | |

Sugg-Letheby burner.
E. G. LOVE, Gas Examiner.

**Good Cement.**—Gutta-percha cuttings are very useful for the laboratory. By dissolving them in benzole and adding a little carmine or any other pig ment, a solution is obtained which, when brushed on the cork and neck of a bottle, forms a tight-fitting cap, impenatrable to air, dampness, alcohol, or acids, and can be taken off without difficulty.—*Scientific Press.*

## Reduction in Price of Gas in Macon, Ga.

The directors of the Macon Gas Light and Water Company, at their last meeting, resolved to reduce the price of gas to $3 per thousand feet after the 1st of October, and to manufacture coal gas.

This will put the best and safest light within reach of every one, and the company hopes the public will show its appreciation of this effort to diminish the expense of living by a liberal patronage in the future. At this low price—the lowest in the South, considering the distance from the coal fields—the company can allow extension of time to no one, and all bills must be paid promptly. All who are in arrears must settle before the 1st of October, in order to participate in the reduced rates. A. E. BOARDMAN,
Superintendent.

The gas company has made a reduction in the price of gas of 25 per cent. No step the company could have taken would have been more popular with all of its customers, and while the reduction has been made, there will be no falling aff in the quality of the article supplied to the consumers. On the contrary, the company has perfected arrangements, and will soon commence the manufacture of coal gas instead of the wood gas which has been exclusively made up to this time. Though the coal gas is more expensive than that made of wood, the reduction will be maintained. Any one who has used both can realize the superiority of the coal over the wood.

This is a step of progress on the part of the company, and one that will be highly appreciated. We hope to see a largely increased consumption in the city. Macon is now furnished with gas at as cheap rates as any cith in the South, although she is a hundred miles further from the supplies of coal from which to manufacture it, than several other Georgia cities.—*Ex.*

## American Ingenuity.

Another answer to the question, "Have Americans ever invented anything?" is furnished by the announcement that a syndicate of five English carpet firms, according to the Manchester *Guardian*, have purchased the patent rights for an ingenious carpet weaving machine, invented by an American, which enables them to produce a carpet—a velvet pile, in appearance and quality said to be a most luxurious article—at a very low cost, which they have named the "Royal Axminster." The machinery is said to be very simple, occupying only half the space of the ordinary carpet looms. The worsted yarns forming the face of the carpet are wound from ordinary bobbin on long bobbins the width of the carpet, the colors being arranged by a comb as the pattern requires. The ends are passed through metal tubes for delivery, and the bobbins, in proper sequence, are then fixed on an endless chain over the loom. As this chain revolves, metal clips seize each bobbin in turn, take it off the chain and dip the ends of worsted among the warp threads of the carpet. Here they are at once firmly fixed, and a circular knife cuts off the worsted at a proper level. The bobbin is returned to the chain and the succeeding one dealt with. Women are now working the looms successfully and earning good wages. The process is considered likely to revolutionize the trade in Axminster carpets.—*Iron Age.*

**Coloring Matters from Coal.**—Dr. Meusel, of Bresleau, prepares coloring matters by treating coal dust with nitric acid, or with a mixture of alkaline nitrates and sulphuric acid, or with other oxidizing agents. A part of the coal is thus rendered soluble with a deep brown color in alkaline hydrates or carbonates. The black residue serves as a body color. The brown alkaline solution can either be used at once, or metallic salts of a black or dark brown color may be precipitated from it, or the precipitate produced by means of acids may be used as a pigment.—*Die Allg. Polyt. Zeitung.*

## Alleged Discovery of Everlasting Fire.

The *Athenæum* says: A correspondent has sent us a startling letter from Miss M. Betham-Edwards, from which we give an extract:

I send you the following particulars of a recent scientific invention, just patented, and destined without doubt, to play a very important part in our economic history. I think it must be regarded as a solution for once and for all of the great coal question—or rather fuel question—not only among ourselves, but abroad. M. Bourbonnel, of Dijon, the celebrated lion and panther slayer, lighted upon the following discovery by hazard, and after six years persistent investigation brought it to entire "workable" perfection. He discovered, by means of two natural substances, inexhaustible in nature, the means of lighting and maintaining a fire without wood or coal; a fire instantaneously lighted and extinguished; a fire causing no dust, smoke, or trouble; a fire costing one-tenth at least of ordinary fuel; and what is more wonderful still, a fire the portion of which answering to our fuel is everlasting—that is to say, would last a lifetime. M. Bourbonnel's invention comprehends both stove and fuel. The fires could be on the minutest scale or on the largest. They could be used for heating a baby's food or roasting an ox. Being lighted instantaneously, they will be a great economy of time. M. Bourbonnel at once patented his invention, and a body of engineers and savants from Paris visited him and pronounced his discovery one of the most remarkable of the age. He has had several offers for the purchase of his patent in France, but wants to sell it in England, his occupation being in another line. I have seen these fires and stoves. There is no mistake about the matter. It is as clear as possible that here we have a perpetual and economical source of fuel. Two hundred years ago the discoverer would have surely been burnt as a wizard.—*Ironmonger.*

**Reduction in Price of Gas in Birmingham, Ct.**—It is well that our people should occasionally know when "they have a good thing." How few of the people of Birmingham and Ansonia know that our gas company is to-day supplying them with gas, that "royal light," cheaper than any other place in the State, Hartford excepted. And yet such is the fact. When the company was started, in '71 or '72, we paid for our gas more than double its present price. One reduction after another has been made by the company, until now we have it at its present low price—about $2.20 on the average. These reductions have always been made by the company without demand, on the principle that they who serve the public best serve themselves best. This has always been true of our company, and its latest reduction, within the month, is something like thirty-five cents per thousand feet. That speaks well for the management.—*Derby Transcript.*

## Gas Stocks.

**Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.**
**(with W B Scott & Co.,)**
24 PINE STREET, NEW YORK CITY.
OCTOBER 2, 1879.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

*Gas Co.'s of N. Y. City.*

| | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Central | 466,000 | 50 | 60 | 75 |
| Harlem | 1,800,000 | 50 | 40 | 45 |
| " Bonds | 170,000 | | | 103 |
| Manhattan | 4,000,000 | 50 | 140 | 145 |
| Metropolitan | 2,500,000 | 100 | 115 | 120 |
| " Scrip | $1,000,000 | ... | 100 | 103 |
| Mutual | 5,000,000 | 100 | 50 | 55 |
| " Bonds, gold | 900,000 | 1000 | 100 | 105 |
| Municipal | 1,500,000 | 100 | 115 | 120 |
| " Bonds | 750,000 | | 105 | 110 |
| New York | 4,000,000 | 100 | 87 | 92 |
| Northern | 270,000 | 50 | — | 100 |

| | | | | |
|---|---|---|---|---|
| *Gas Co's of Brooklyn.* | | | | |
| Brooklyn | 2,000,000 | 25 | 110 | 115 |
| Citizens | 1,200,000 | 20 | 55 | 60 |
| " S. F. Bonds. | 320,000 | 1000 | 100 | 102 |
| Peoples | 1,000,000 | 10 | 18 | 25 |
| " Bonds | 325,000 | ... | -- | 95 |
| " Scrip | 300,000 | ... | 75 | 80 |
| Metropolitan | 1,000,000 | 100 | 40 | 50 |
| Nassau | 1,000,000 | 25 | 50 | 60 |
| " Ctfs. | 700,000 | 1000 | 80 | 85 |
| Williamsburgh | 1,000,000 | 50 | 70 | 75 |
| " Scrip | | ... | 90 | 95 |
| Kings Co | 200,000 | 100 | — | 70 |
| Union Co. E. N. Y. | | 25 | — | 50 |
| Richmond Co., S. I. | 300,000 | ... | 60 | 85 |
| *Out of Town Gas Companies.* | | | | |
| Bath, Maine | 70,000 | 100 | | |
| Buffalo Mutual, N.Y | 750,000 | 100 | 65 | 70 |
| " Bonds | 200,000 | 1000 | 95 | 100 |
| Baltimore, Md. | 2,000,000 | 100 | 95 | 98 |
| " Ctfs., gold | 1,000,000 | | 95 | 10 |
| Bayonne, N. J. | | 100 | | 90 |
| Brockport, N. Y. | 25,000 | 100 | ... | 80 |
| Citizens, Newark | 918,000 | 50 | 100 | 103 |
| " " Bds. | 124,000 | — | 105 | 10 |
| Chicago Gas Co., Ills | | | 132 | — |
| Cincinnati G. & C. Co. | | | | 190 |
| Derby of Conn. | 160,000 | 100 | 60 | 80 |
| East Boston, Mass | | 25 | 114 | 120 |
| Elizabethtown, N. J. | 300,000 | 20 | — | 130 |
| Fort Wayne, Ind. | | 100 | ... | — |
| Hannibal, Mo. | 100,000 | 100 | 95 | 100 |
| Hartford, Conn. | 700,000 | 25 | 120 | 125 |
| Hempstead, L. I. | 25,000 | 100 | ... | — |
| Jersey City | 750,000 | 20 | 145 | 155 |
| Jamaica, L. I. | 25,000 | 100 | ... | — |
| Jacksonville, Ill. | 120,000 | 50 | 100 | ... |
| Lewistown Maine | 400,000 | 100 | 70 | 80 |
| Lima, Ohio, | 60,000 | 100 | — | ... |
| Bonds | 30,000 | | 90 | |
| Laclede St Louis Mo. | 1,200,000 | 100 | — | 75 |
| Long Branch | | 20 | 30 | 40 |
| New Haven, Conn | | 25 | 152 | — |
| Peoples, Jersey City | | ... | — | 80 |
| " " Bds. | | | | 95 |
| Peoples of Albany | 650,000 | 100 | — | 10 |
| " Bonds | 350,000 | 1000 | -- | - |
| Peoples of Baltimore | | 25 | 44 | 48 |
| " Bonds | | | 106 | — |
| Plainfield, N. J. | 80,000 | 100 | — | 105 |
| Perth Amboy | | 25 | — | 95 |
| Rochester, N. Y. | | 50 | 70 | 80 |
| " Citizens | | 100 | 50 | 60 |
| Toledo, Ohio | | | 95 | 97 |
| Washington, D. C. | 1,500,000 | 20 | — | 200 |
| " Scrip | 500,000 | 20 | 100 | — |
| Yonkers | | 50 | — | 70 |
| Woonsocket, R. I. | 150,000 | 100 | 80 | ... |
| Halifax N. S. | 400,000 | 40 | 148 | 150 |
| Hamilton, Ontario | 150,000 | 40 | 117½ | |
| Pittsfield, Mass | | | 120 | 130 |
| Rondout & Kingston | | | 75 | 80 |
| St. Louis Missouri | 600,000 | 50 | 72 | 75 |
| Stillwater, Minn. | 50,000 | 50 | — | 26 |
| Saugerties, N. Y. | 15,000 | 100 | 95 | 100 |
| Troy, Citizens | 600,000 | 100 | — | 60 |
| San Francisco Gas-Co., S. Fr'isco Cal. | | | 95 | 95¼ |

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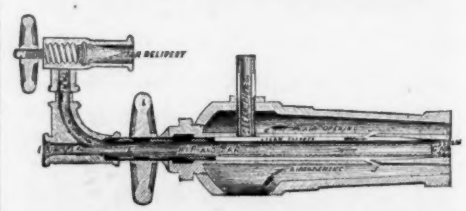

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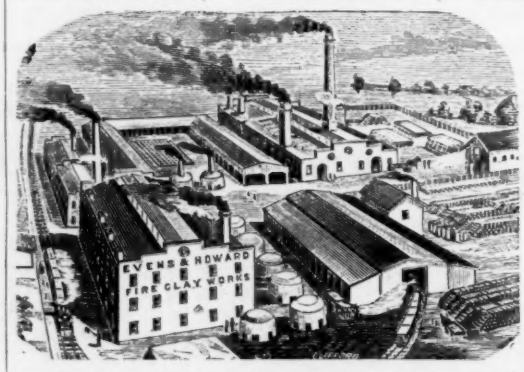


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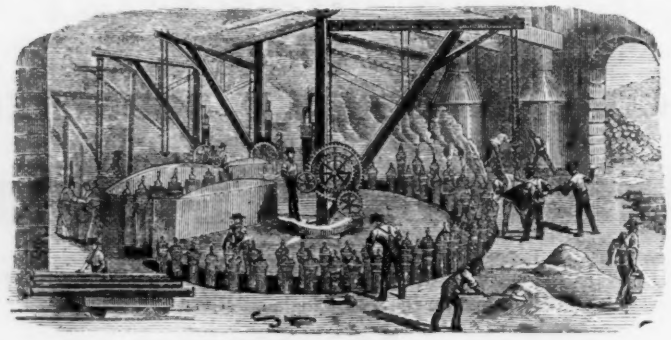

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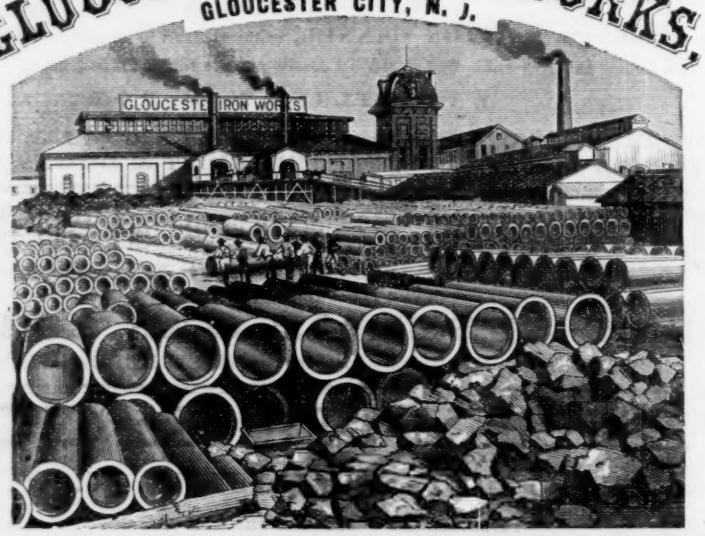

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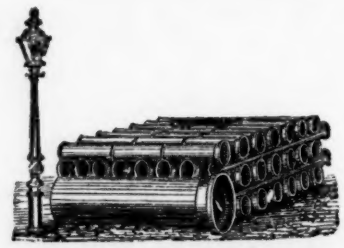

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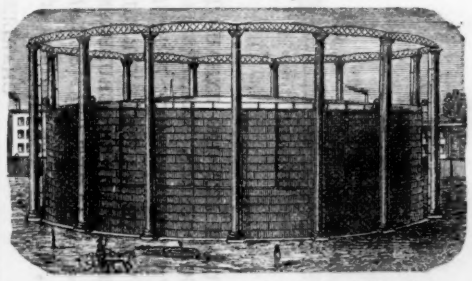

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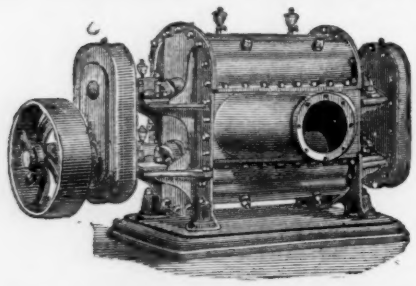

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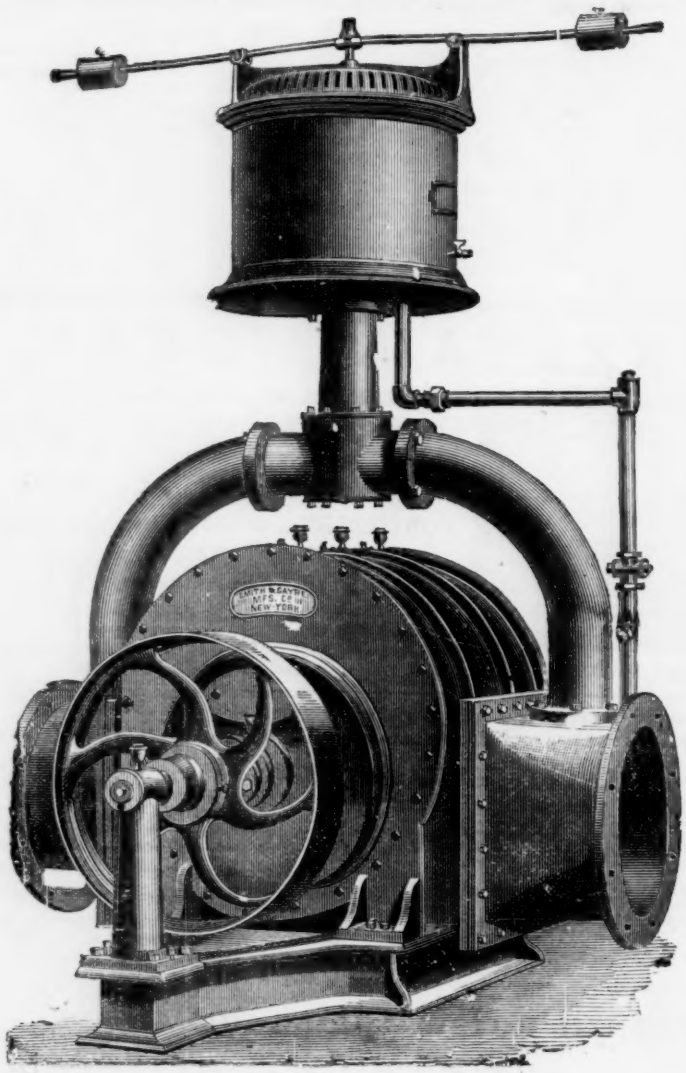


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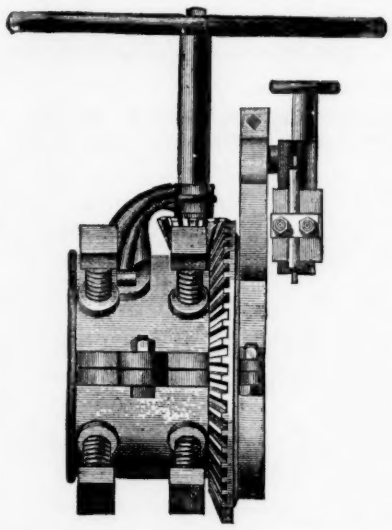

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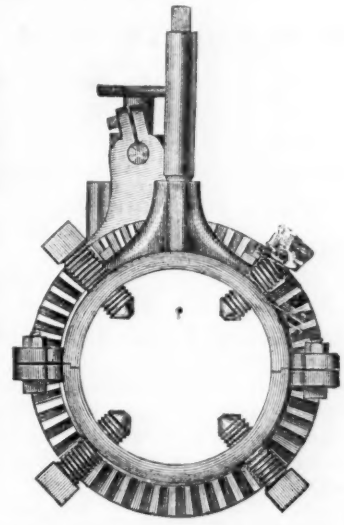

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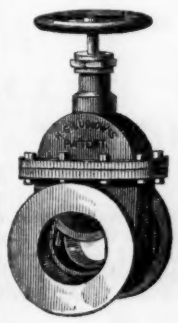

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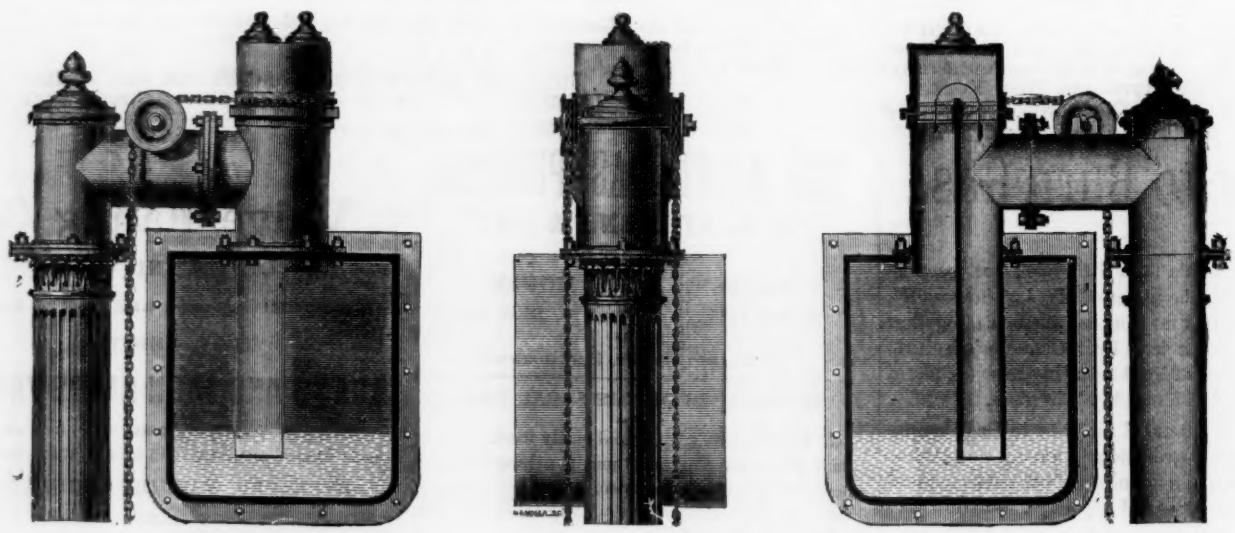

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